A380
TECHNICAL TRAINING MANUAL
MAINTENANCE COURSE - T1 & T2 (RR / Metric)
LEVEL II - ATA 70 Power Plant (RR)

This document must be used for training purposes only

Under no circumstances should this document be used as a reference

It will not be updated.

LEVEL II - ATA 70 POWER PLANT (RR)

Powerplant

Theory System

Engine system

Engine Start assistance

L1W06161 - L0KT0T0

POWERPLANT DESCRIPTION (2)

Working Area

Engine Not Running

Even if the engine is not running, the area is still dangerous and the personnel has to obey the precautions, which are given to operate an engine safely.

Engine Running

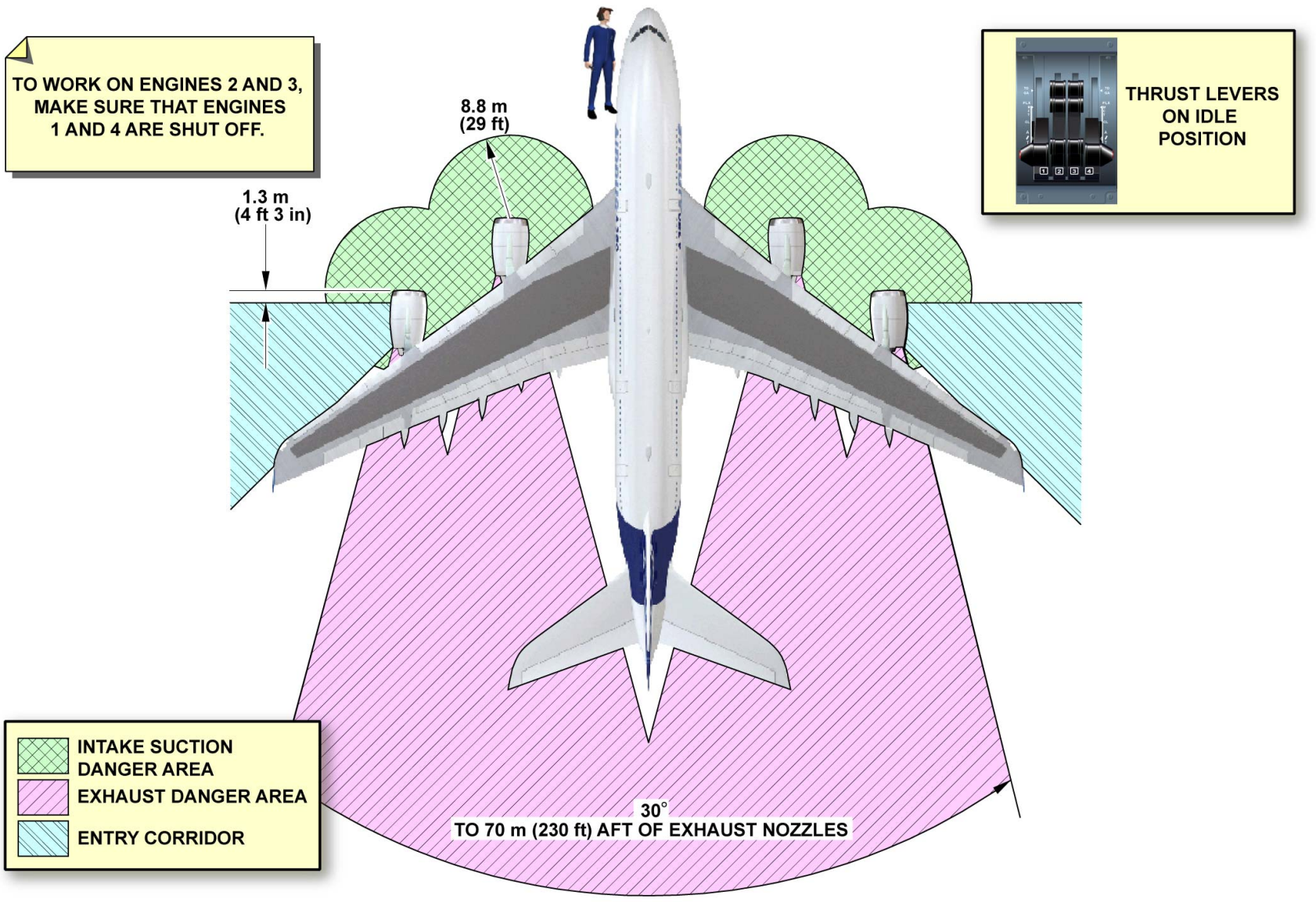
To enable personnel safety when he has to act exceptionally on a running engine, the power level must be kept to the minimum necessary by setting thrust levers to the IDLE position.
The restricted areas are:
- the intake suction area: in a radius of 8.8 m (29 ft),
- the exhaust danger area: a corridor of 30° from the exhaust nozzles to 70 m (230 ft) afterwards.

To work on the engine safely, you must use the entry corridors located at the engine outboard side 1.3 m (4 ft) aft of the air intake cowl.

NOTE: To work on the inboard engines, the outboard engines must be shut off first.

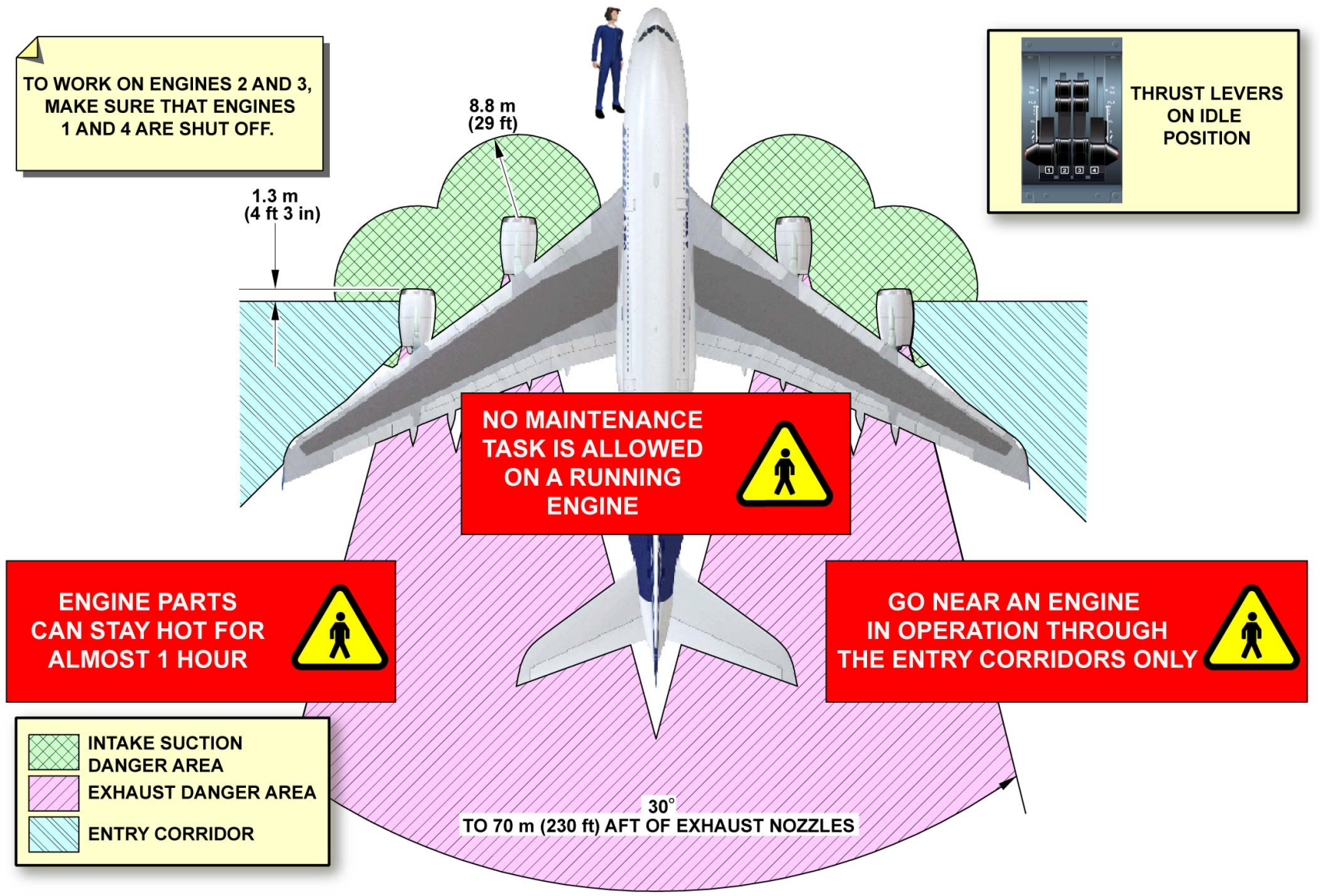
Human factor points:

WARNING: - BE CAREFUL WHEN YOU DO WORK ON THE ENGINE PARTS AFTER THE ENGINE IS SHUTDOWN. THE ENGINE PARTS CAN STAY HOT FOR ALMOST 1 HOUR.
- UNDER NORMAL CONDITIONS, EXCEPT IN THE ASSISTED MANUAL START SEQUENCE, THERE IS NO NEED AND IT IS NOT ALLOWED TO PERFORM MAINTENANCE TASKS ON A RUNNING ENGINE.
- DO NOT GO NEAR AN ENGINE THAT IS IN OPERATION ABOVE LOW IDLE. IF YOU DO, IT CAN CAUSE AN INJURY. GO NEAR AN ENGINE IN OPERATION THROUGH THE ENTRY CORRIDORS ONLY.



WORKING AREA - ENGINE NOT RUNNING & ENGINE RUNNING

L1W06161 - L0KT0T0 - LM7RDVLEVEL0201



WORKING AREA - ENGINE NOT RUNNING & ENGINE RUNNING

L1W06161 - L0KT0T0 - LM7RDVLEVEL0201

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POWERPLANT DESCRIPTION (2)

Drain System

The powerplant drains system can be divided into four types of drains:
- fuel,
- oil,
- hydraulic and,
- the others.

The drained fluids exit via a drain mast that is mounted on the rear face of the external gearbox at the split line between the two fan cowl doors.

Fuel System Drains

Drain system collects and discards fuel, which has not been burnt because of an engine shutdown or an engine failure to start. It also discards fluids that leak into certain components and all unwanted fluids that leak into certain engine areas. A drain tank is installed on the lower starboard side of the rear fan case to collect fuel drained from the fuel spray nozzle manifold during normal engine shutdown or failures to start. The contents of the drain tank are drawn back into the main fuel system during subsequent engine running, an overflow pipe is provided to drain excess fuel overboard, once the drain tank is full.

Drain lines take fuel from:
- the fuel pump,
- the Variable Stator Vane Actuators (VSVAs).

The drain lines are separated to get easy troubleshooting. The VSVA lines are grouped together and sumps enable leaking units to be identified.

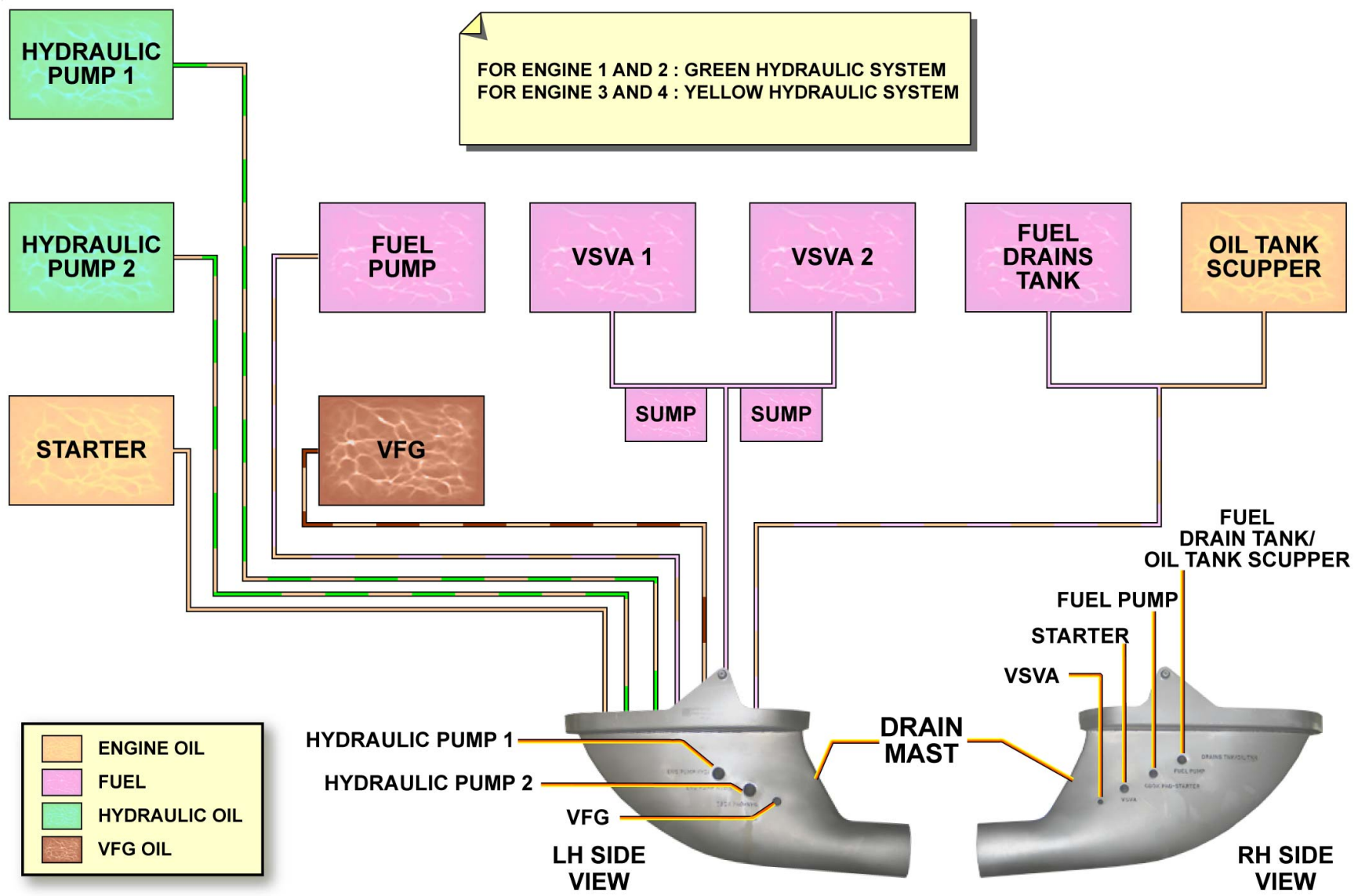
Oil System Drains

Drain lines take oil from:
- the oil tank filler scupper,
- the air starter,
- the Variable Frequency Generator (VFG).

The oil spilled during servicing is collected in the oil tank filler scupper. The drain lines from oil tank scupper are grouped with those from the fuel drain tank and routed to the drain mast.

Hydraulic System Drains

Drain lines take hydraulic fluid from:
- the hydraulic pump 1,
- the hydraulic pump 2.



DRAIN SYSTEM - FUEL SYSTEM DRAINS ... HYDRAULIC SYSTEM DRAINS

L1W06161 - L0KT0T0 - LM7RDVLEVEL0201

POWERPLANT DESCRIPTION (2)

Drain System (continued)

Leakage Rates

To be sure that an engine operates correctly, the leakage rates at drain mast have to be monitored, checked and measured. The leakage rates for each system have to be within the acceptable limits specified by the engine manufacturer. If this is not the case, further troubleshooting is necessary to identify the source of the leak.

POWER LEAKAGE RATES - MAXIMUM ACCEPTANCE STANDARDS		
UNIT	FLUID	LEAKAGE RATE
FUEL PUMP	FUEL	10 DROPS/MINUTE (30 CC/HOUR) WHEN THE ENGINE IS IN OPERATION
	ENGINE OIL	1 DROP/MINUTE (1 CC/HOUR)
VARIABLE STATOR VANE ACTUATOR (VSVA)	FUEL	3 DROPS/MINUTE (10 CC/HOUR) FOR EACH ACTUATOR WHEN THE ENGINE IS IN OPERATION
ENGINE (HYDRAULIC) PUMP	HYDRAULIC OIL	TO BE FURNISHED BY AIRBUS INDUSTRIE
	ENGINE OIL	1 DROP/3 MINUTES (1 CC/HOUR) FOR EACH PUMP WHEN THE ENGINE IS IN OPERATION
VARIABLE FREQUENCY GENERATOR (VFG)	OIL (VFG SYSTEM)	REFER TO AMM TASK 71-71-00-991-005
VARIABLE FREQUENCY GENERATOR (VFG)	ENGINE OIL	1 DROP/3 MINUTES (1 CC/HOUR) WHEN THE ENGINE IS IN OPERATION
		1 DROP/6 MINUTES (0.5 CC/HOUR) WHEN THE ENGINE IS NOT IN OPERATION
PNEUMATIC STARTER	OIL (STARTER SYSTEM)	VERY SMALL LEAKAGE ONLY WHEN THE ENGINE IS NOT IN OPERATION
OIL TANK SCUPPER	ENGINE OIL	1 DROP/3 MINUTES (1 CC/HOUR) WHEN THE ENGINE IS IN OPERATION
FUEL DRAIN TANK	FUEL	10 DROPS/MINUTE (30 CC/HOUR) WHEN THE ENGINE IS IN OPERATION
		NO LEAKAGE WHEN THE ENGINE IS NOT IN OPERATION

DRAIN SYSTEM - LEAKAGE RATES

POWERPLANT DESCRIPTION (2)

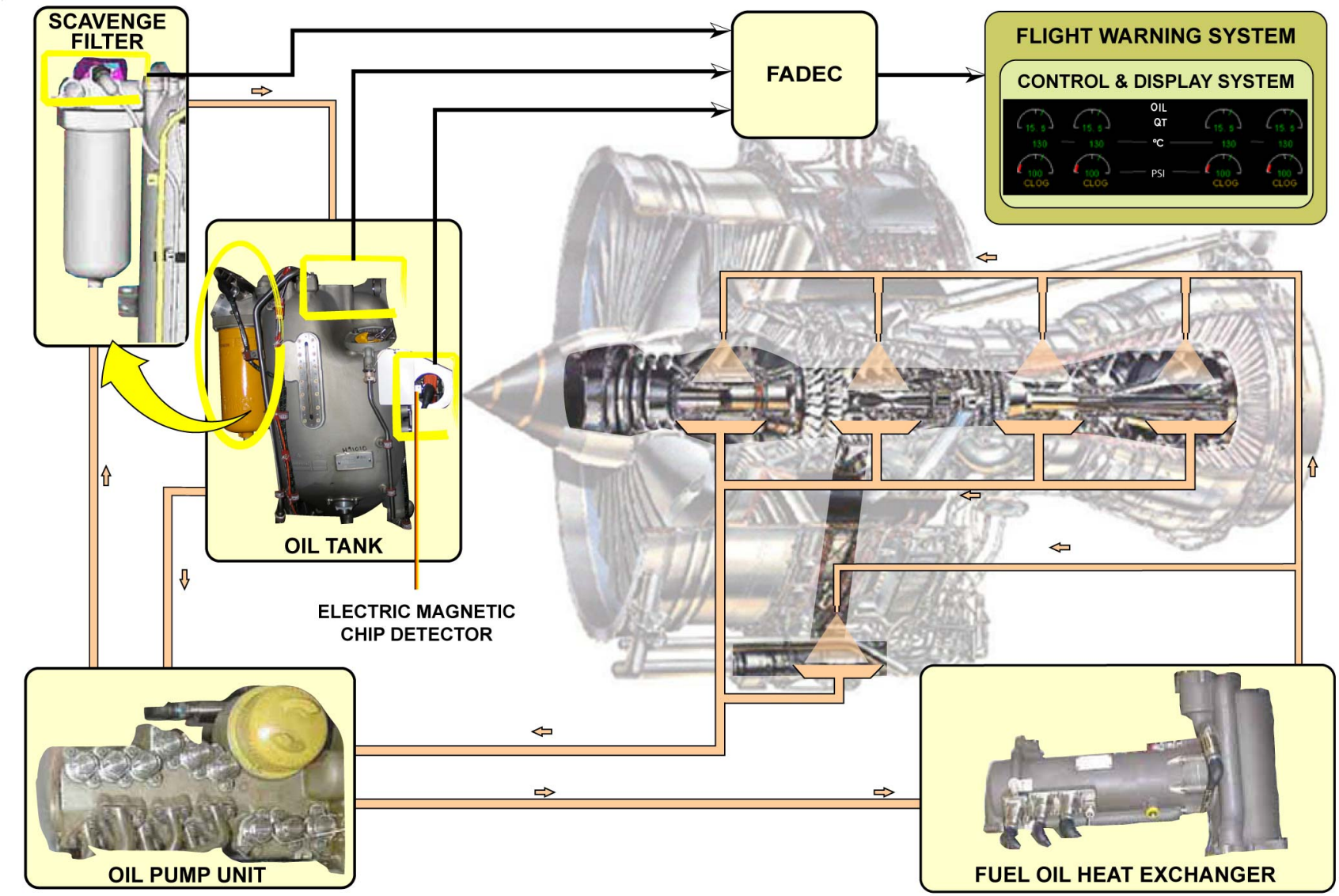
Engine Oil

System Architecture

The engine oil system serves to lubricate and cool the engine internal drives, gears and bearings. The system is composed of:
- an oil tank used for the storage of the oil,
- an oil pump unit, which supplies pressure to move the oil to or from the drives, gears and bearings,
- a fuel oil heat exchanger, which decreases the oil temperature and increases the fuel temperature,
- a scavenge filter, which avoids unwanted particles in the re-circulated oil to enter into the oil tank.

The oil filter has a differential pressure transducer, which compares the difference between upstream and downstream pressures to determine if the filter is clogged. In this case, the difference will increase, and transducer will send a signal to the cockpit Full Authority Digital Engine Control (FADEC). After data possessing, the FADEC will send a signal to the Flight Warning System (FWS) for cockpit indications.

Each oil tank has an electric magnetic chip detector to attract magnetic debris in the oil. This metallic oil contamination is shown on the ECAM and on the Onboard Maintenance System (OMS) devices for maintenance.



ENGINE OIL - SYSTEM ARCHITECTURE

L1W06161 - L0KT0T0 - LM7RDVLEVEL0201

POWERPLANT DESCRIPTION (2)

Engine Oil (continued)

Servicing

The engine oil servicing is done by the filling of the engine oil system with approved oil and by inspecting the system in order to find and correct the engine oil contamination.

Inspection of scavenge oil filter

To examine the scavenge filter element, it must be removed first. The presence of particles has to be detected and these particles have to be removed. The filter and the filter housing have to be cleaned if magnetic particles are found in the scavenge filter, the electric magnetic chip detector also has to be examined. After examination of the particles, the filter and its seal have to be replaced by new ones. The fuel and oil leak check on the scavenge filter housing is required before putting the aircraft back into operation.

Inspection of Electric Magnetic Chip Detector

To examine the electric magnetic chip detector, it must be removed first. The presence of particles has to be detected and these particles have to be removed. The detector and the particles are examined. After examination of the particles, the detector can be re-installed but the two seal rings have to be replaced by new ones. The oil leak check on the detector housing is required before putting the aircraft back into operation.

Refill of engine oil tank

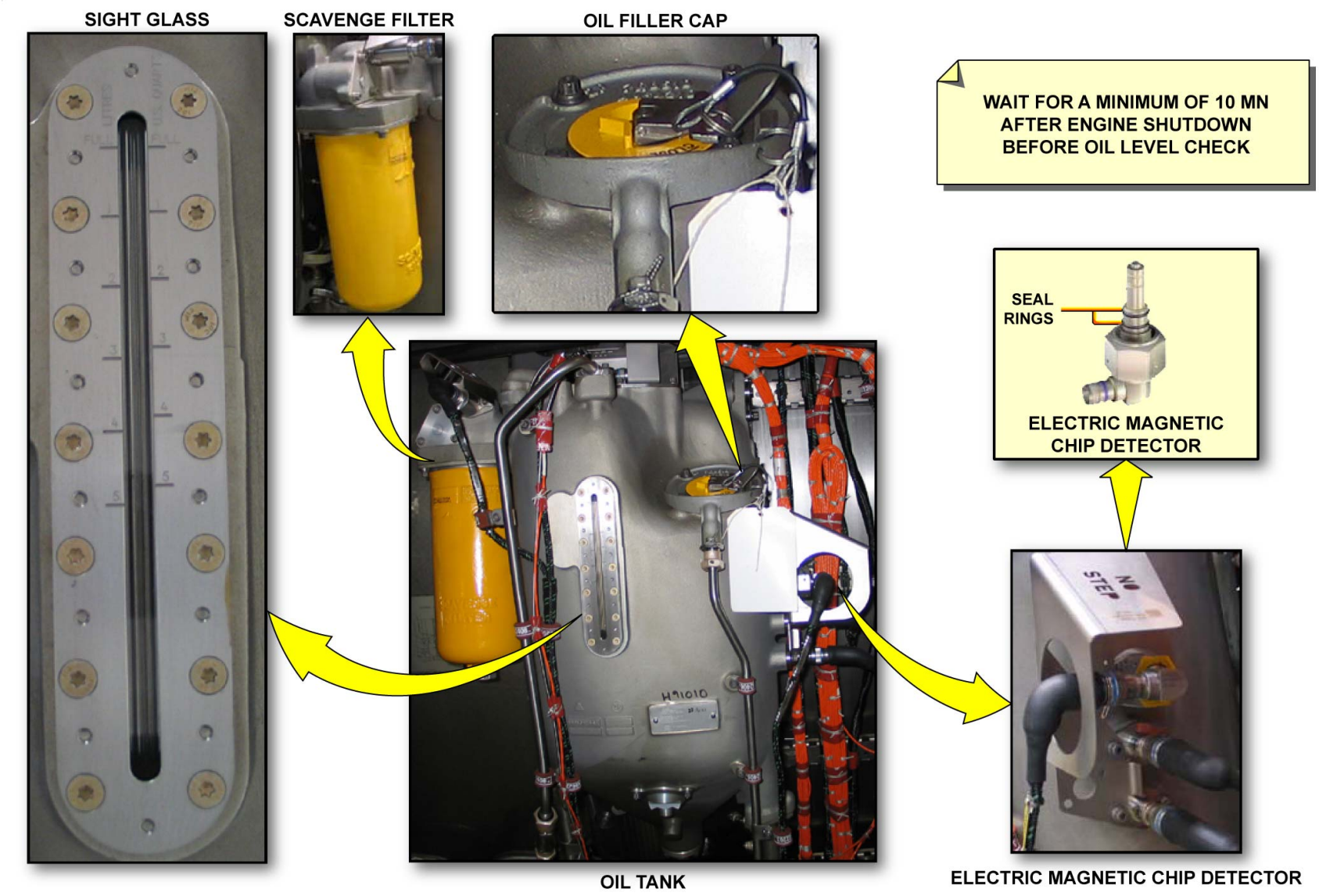
Before replenishing the oil tank, a visual check of the engine oil level in the sight glass of the oil tank must be done. If the engine has been stopped for more than six hours; the engine has to be operated at IDLE before refilling the oil tank by respecting the duration between engine shutdown and the oil tank refilling. To refill the tank, the oil filler cap is removed and the engine lubricating oil also known as material No. OMat 1011 is added. The check for fuel fumes in the tank is required before putting the aircraft back into operation.

NOTE: You must wait for a minimum of 10 minutes after the engine has stopped before you do a check of the oil level. This will let the oil level become stable.

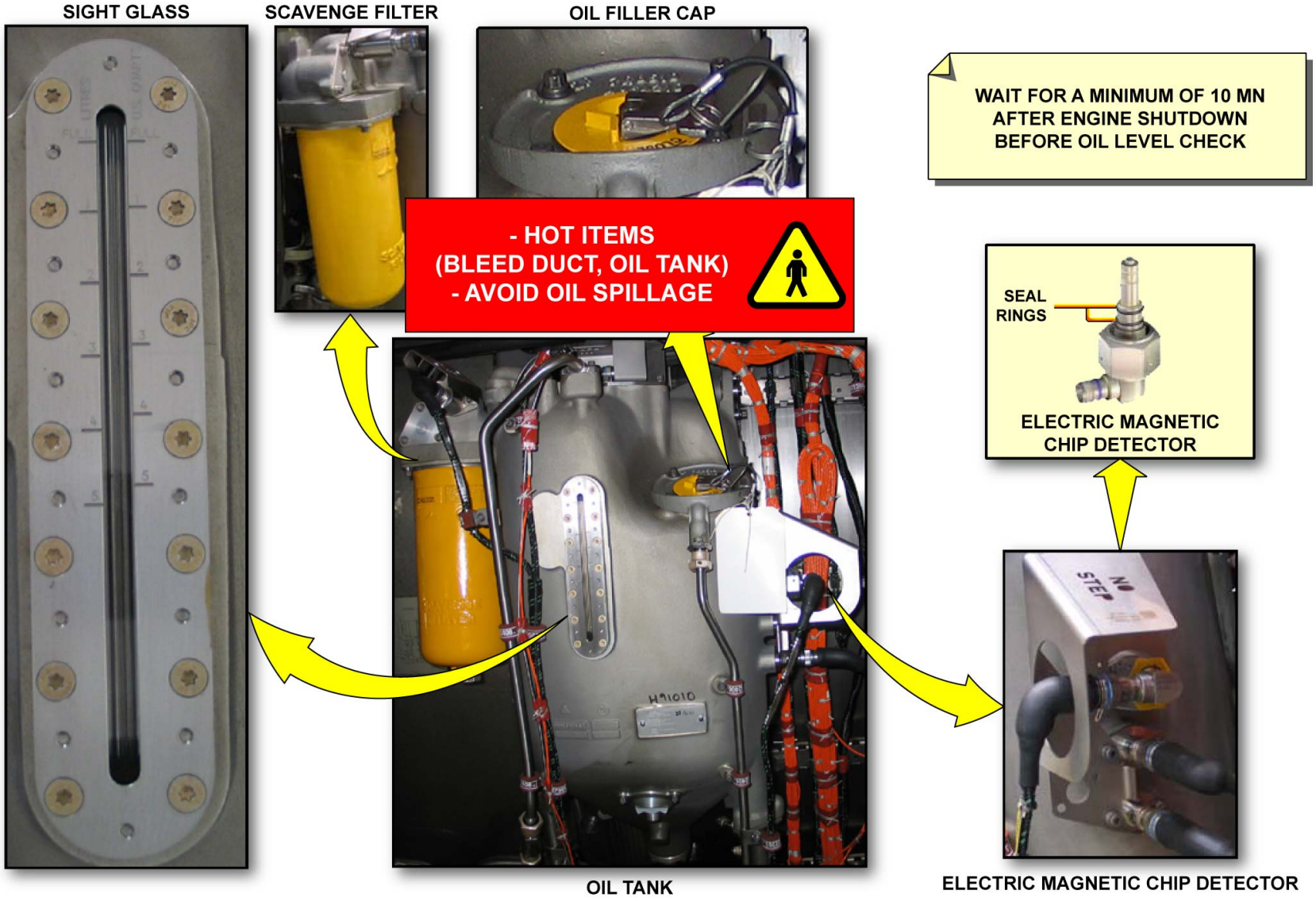
Human factor points:

WARNING: - BE CAREFUL, THE ENGINE PARTS (BLEED DUCT, OIL TANK) CAN STAY HOT FOR ALMOST 1 HOUR AFTER SHUTDOWN.

CAUTION: - AVOID SPILLAGE WHEN SERVICING OIL.



ENGINE OIL - SERVICING



ENGINE OIL - SERVICING

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ENGINE DRIVEN PUMP DESCRIPTION (2)

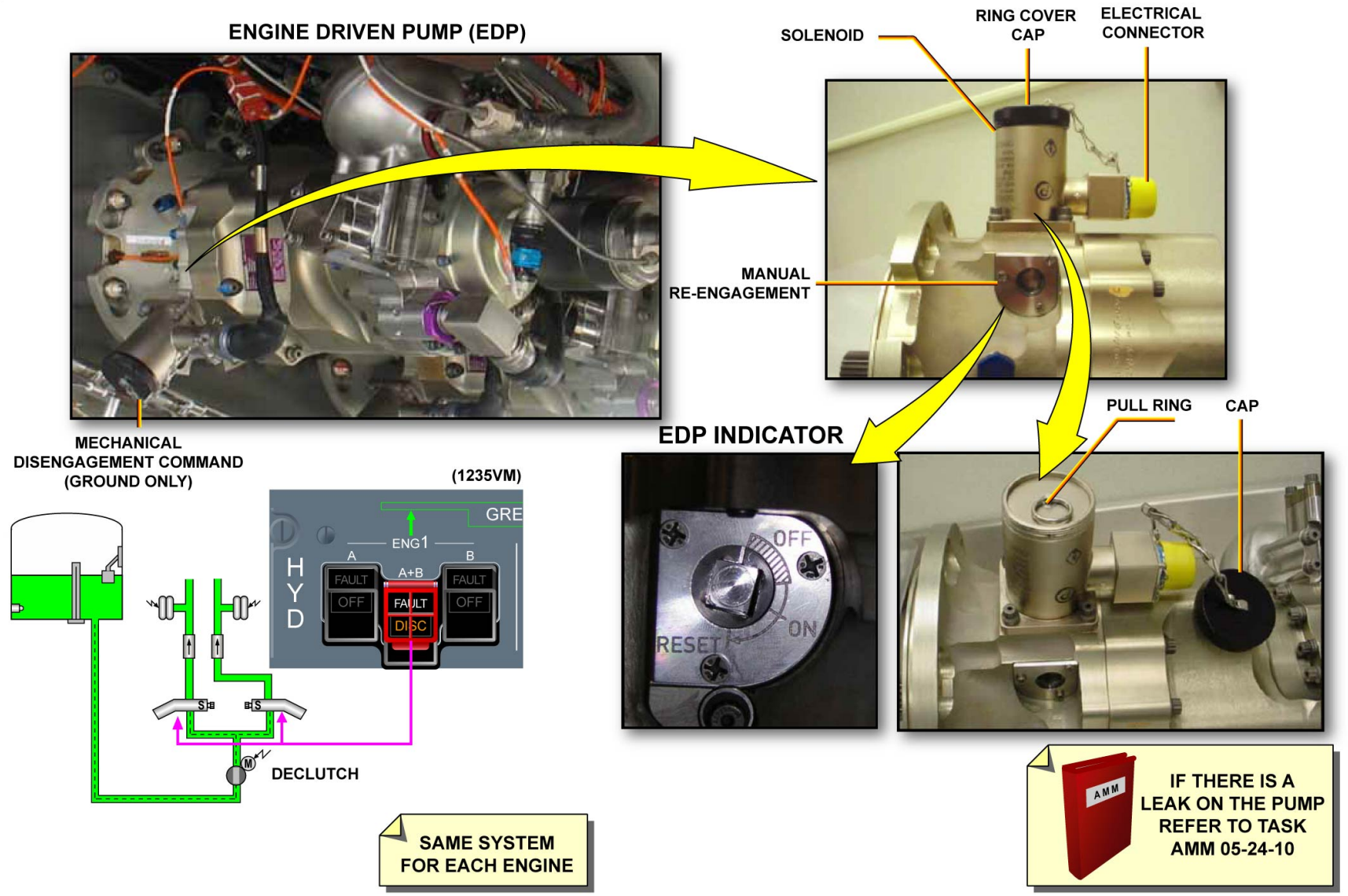
Disengagement/Re-engagement

It is possible to do a mechanical disengagement of the Engine Driven Pump (EDP) from the engine gearbox by means of the declutch system.
In flight, the EDP disengagement will be operated through an electrical solenoid, from an electrical switch (28VDC) on the hydraulic panel. In this case, both pumps of the given engine will be de-clutched.
The disengagement of the EDP is irreversible in flight until a specific maintenance action is done.
On the ground, for maintenance purpose, the EDP can be manually de-clutched by pulling a ring outward.
The re-engagement of the EDP can be made manually (engine shut down) by acting on the reset port.

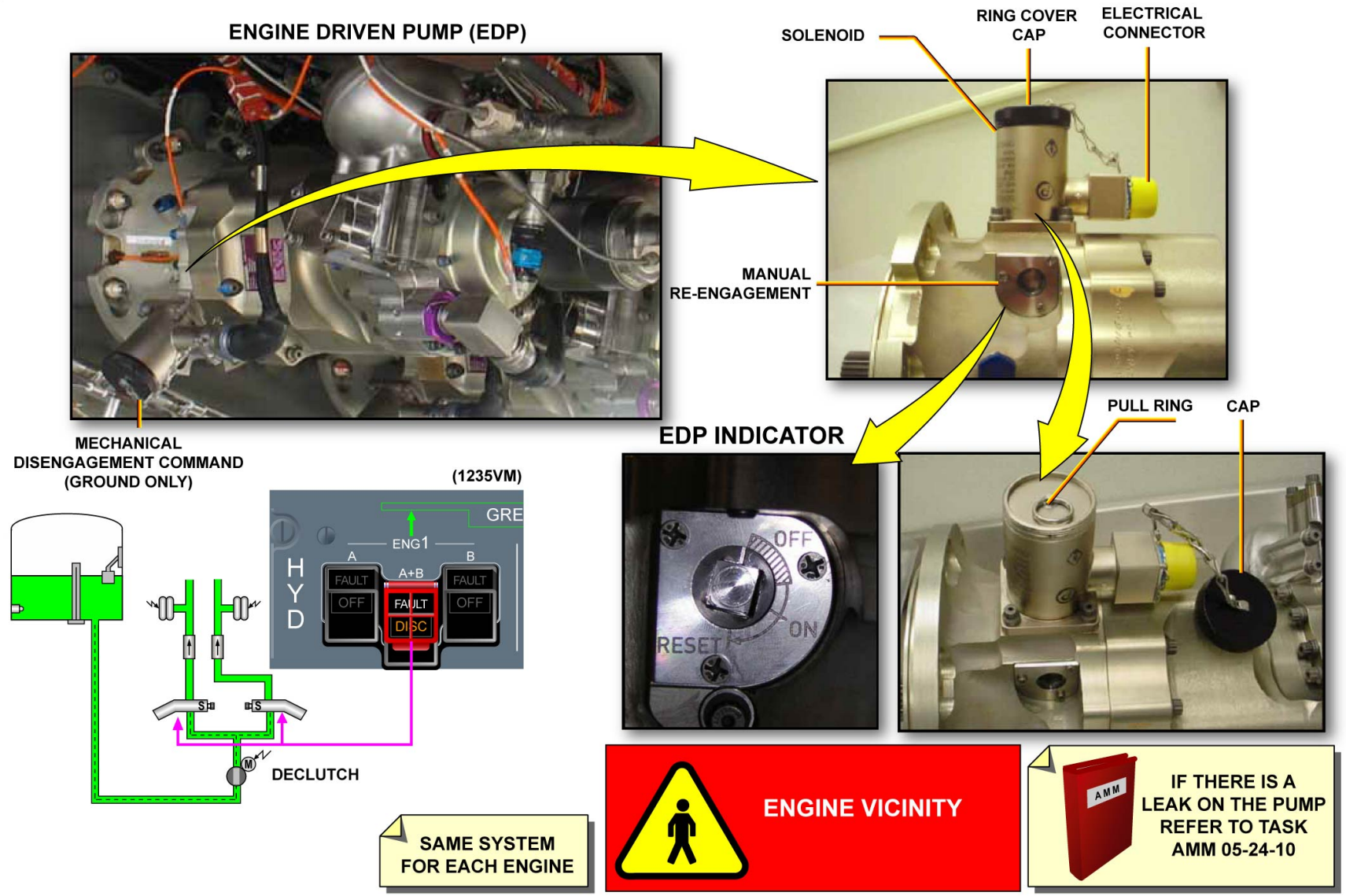
NOTE: Note: If there is a leak on the pump, refer to the AMM task 05-24-10

WARNING: While approaching the engine, the air intake suction or exhaust blow could injure. Therefore accessing the engine from its side within the safety area will prevent this.

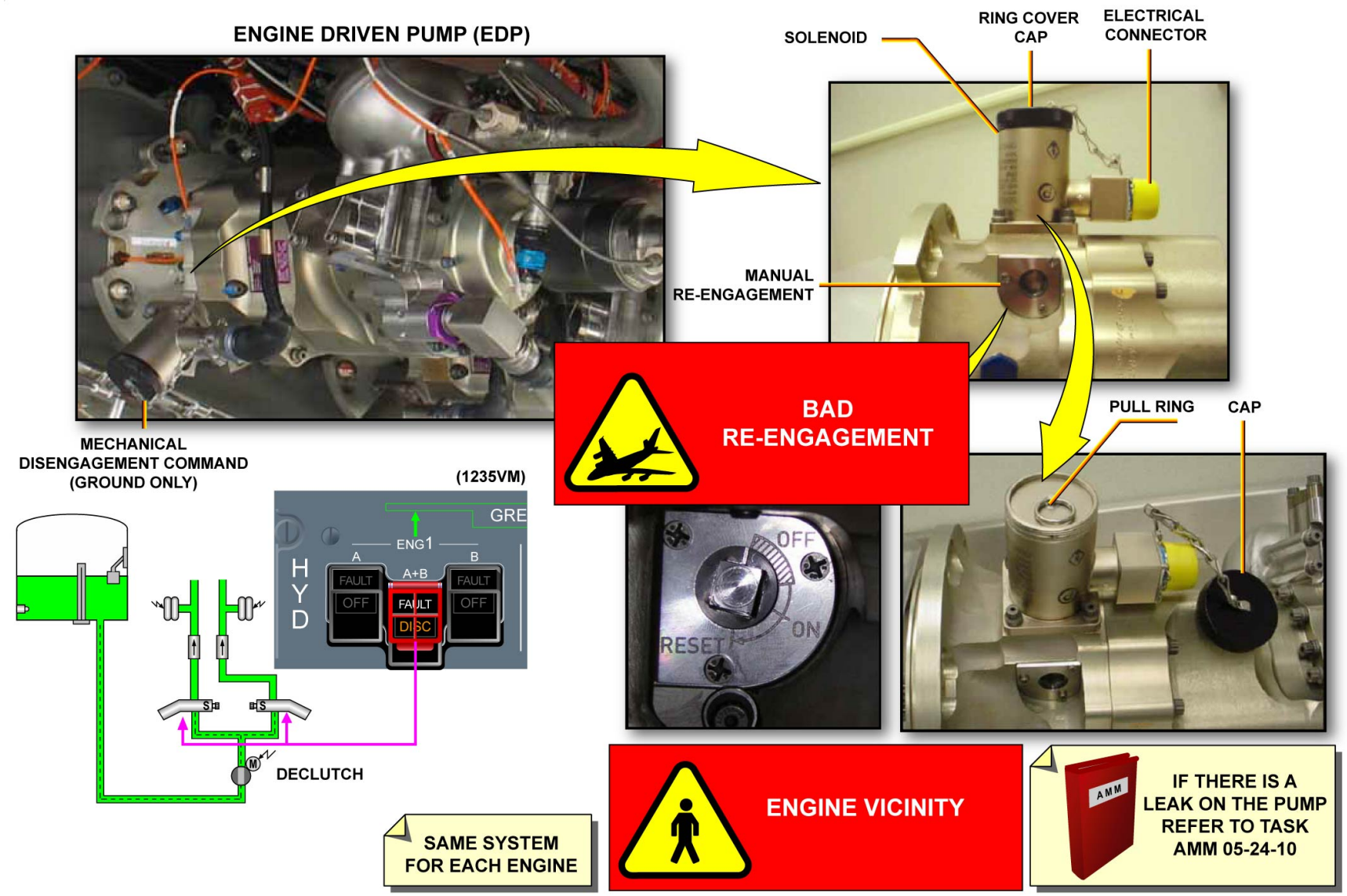
CAUTION: When manually re-engaging the EDP, it is possible not to rearm properly the system, leading to an inadvertent disengagement when the engine will be running (vibration effect). To prevent this, turning the RESET shaft until the RESET mark will fulfill a proper re-engagement of the pump.



DISENGAGEMENT/RE-ENGAGEMENT



DISENGAGEMENT/RE-ENGAGEMENT



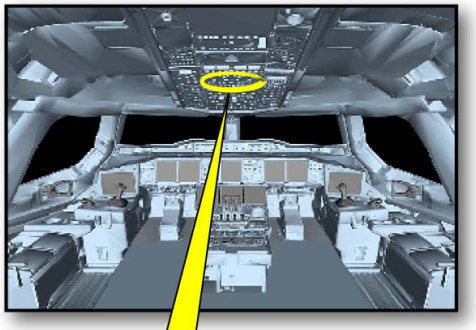
DISENGAGEMENT/RE-ENGAGEMENT

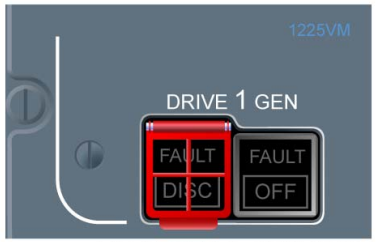
L1W06161 - L0KT0T0 - LM7RDULEVEL0201

VFG - OIL SERVICING DESCRIPTION (2)

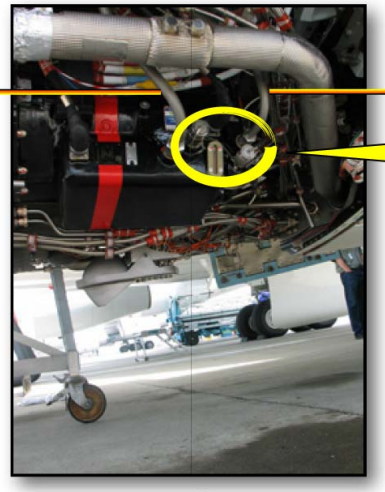
Description

The Variable Frequency Generator (VFG) is mounted on the engine accessory gearbox located in the engine nacelle.
The filling ports and a sight glass are mounted on the LH side of the VFG.
The VFG is cooled and lubricated by an internal oil cooling system with an engine mounted, called the Air Cooled Oil Cooler (ACOC).
This ACOC uses airflow from the fan case to cool the VFG oil.
The cooling system limits the temperature VFG oil inlet to 125°C.
A manual disconnection of a faulty VFG could be done through the DRIVE P/B on the overhead ELEC panel (1225 VM).
When disconnected, VFG cannot be reconnected and should be removed from the A/C.

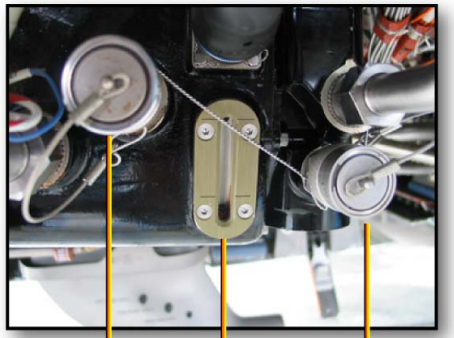




ELEC PANEL (1225 VM)



VFG



DESCRIPTION

VFG - OIL SERVICING DESCRIPTION (2)

Oil Servicing

Level Check

There are two ways to do a check of the oil level:
- on the vertical sight glass, directly installed on the VFG,
- with the Remote Oil Level Sensor (ROLS).

The ROLS gives indications on the Central Maintenance System (CMS), through the servicing report or on the ECAM in case of a low level.
The ROLS has three sensors for three different levels:
- an oil level overfill sensor which results in the message "FULL/OVERFILL OIL LEVEL",
- a low level sensor, which gives the message "LOW OIL LEVEL" (500 hours before refill),
- a very low level sensor which gives the message "VERY LOW OIL LEVEL".

Those messages are presented on the SD status page.
They appear as well as on the servicing report or by using the CMS via the fault flight report.
The ROLS operates on ground four minutes after engine shutdown.

NOTE: Note: To access to the VFG, it is necessary to open the fan cowl.

DPI

The Differential Pressure Indicator (DPI) extends if the oil filter is clogged.
At the same time, it triggers a message through the Generator and Ground Power Control Unit (GGPCU) to the CMS.
In that case, applicable procedure for oil filter check should be done.

Refilling

For the refilling connect the pressure fill hose of the pump-hand, oil filling-up to the pressure fill port.
The oil overflow is collected from the over fill drain port into a container.
A visual check could be done on the sight glass.
Human factor points:

WARNING: - YOU MUST BE CAREFUL WHEN YOU DO WORK ON THE ENGINE PARTS AFTER THE ENGINE IS SHUTDOWN. THE ENGINE PARTS CAN STAY HOT FOR ALMOST 1 HOUR.
- YOU MUST NOT LET ENGINE OIL STAY ON YOUR SKIN. FLUSH THE OIL FROM YOUR SKIN WITH WATER.
- YOU MUST NOT BREATHE THE FUMES.
- YOU MUST NOT GET ENGINE OIL IN YOUR EYES OR IN YOUR MOUTH. PUT ON GOGGLES AND A FACE MASK.
- IF YOU GET ENGINE OIL IN YOUR MOUTH, YOU MUST NOT CAUSE VOMITING BUT GET MEDICAL AID IMMEDIATELY.

Human factor points:

CAUTION: - TO PREVENT DAMAGE, DO NOT DO THE SERVICING OF A DISCONNECTED VFG.
- DO NOT USE DEVICES OTHER THAN THE APPROVED OVERFLOW DRAIN-HOSE FITTING. HARD METAL OBJECTS SUCH AS SCREWDRIVERS CAN CAUSE DAMAGE TO THE OVERFLOW DRAIN-VALVE SEAT.
- USE ONLY NEW OIL CANS, WHEN YOU FILL THE VFG WITH OIL OR ADD OIL TO THE VFG.

THE CONTAMINATION IN OIL THAT STAYS IN OPEN CANS CAN CAUSE FAST DETERIORATION OF THE OIL AND WILL DECREASE THE LIFETIME OF THE VFG.

- DO NOT USE SOLVENTS THAT CONTAIN CHLORINE TO CLEAN THE EQUIPMENT (PUMP, HOSES, TANK AND FUNNEL) USED TO FILL THE VFG WITH OIL. CHLORINE CONTAMINATION OF THE OIL CAN CAUSE FAST DETERIORATION OF THE OIL AND WILL DECREASE THE LIFETIME OF THE VFG

ENGINE COWLING DESCRIPTION (2)

Fan Cowl

Opening

The fan cowl doors can be opened for maintenance purposes on the engine. The unlatching sequence is carried out from the latch access panel located at the split line between the two fan cowl doors. Unlocking of the four latches is done in a defined sequence: L4 first, L1, L3 and L2 at the end. Once the fan cowl doors are unlocked, the opening is done from the fan cowl P/B control switches installed on the air intake cowl, at the RH and LH sides of the engine. The maintenance personnel must push and hold the UP switch until the fan cowl door has reached the desired position. The Hold Open Rods (HORs) are automatically locked. When a HOR is locked the green indicator is visible in the full open position. Then the maintenance personnel must push the DOWN switch to hold the cowl on the HORs.
The fan cowl doors have two open positions:
- intermediate position of 40 degrees,
- full open position of 50 degrees.
The fan cowl doors can be directly opened from zero to the full open position.

NOTE: There are three flag indicators to know the HOR state:
- red indicator, unlocked between 0º and 40º positions,
- orange indicator, locked on 40º position and unlocked between 40º and 50º positions,
- green indicator, locked at 50º position; orange indicator still visible.

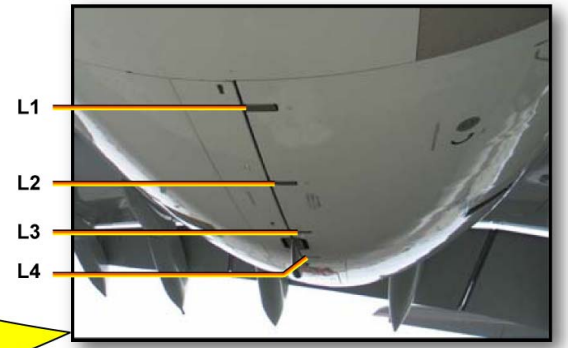
Human factor points:

CAUTION: - MAKE SURE THAT THE WIND SPEED CONDITIONS ARE NOT MORE THAN 45 KNOTS.
- BEFORE YOU FULLY OPEN THE FAN COWLS; MAKE SURE THAT SLATS ARE RETRACTED AND THAT THEY CANNOT MOVE TO PREVENT FROM POSSIBLE INTERFERENCES.

FAN COWL CLOSED

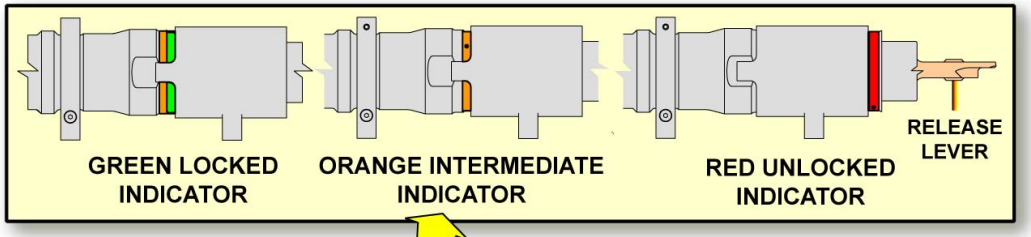
FAN COWL

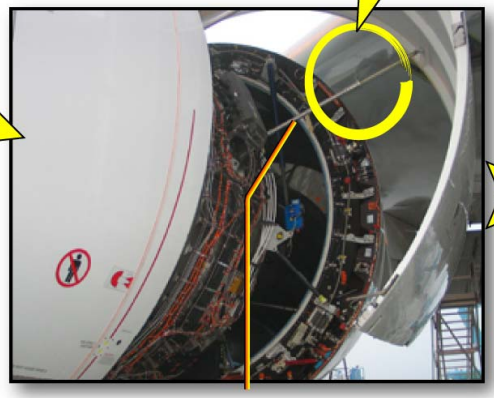
UNLATCH SEQUENCE:
L4, L1, L3 AND L2



FAN COWL LATCHES

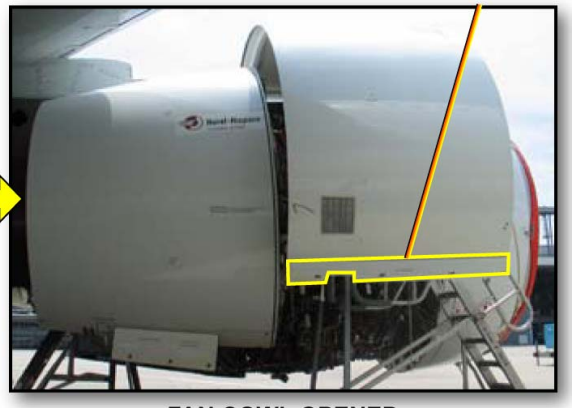
FAN COWL P/B CONTROL SWITCH





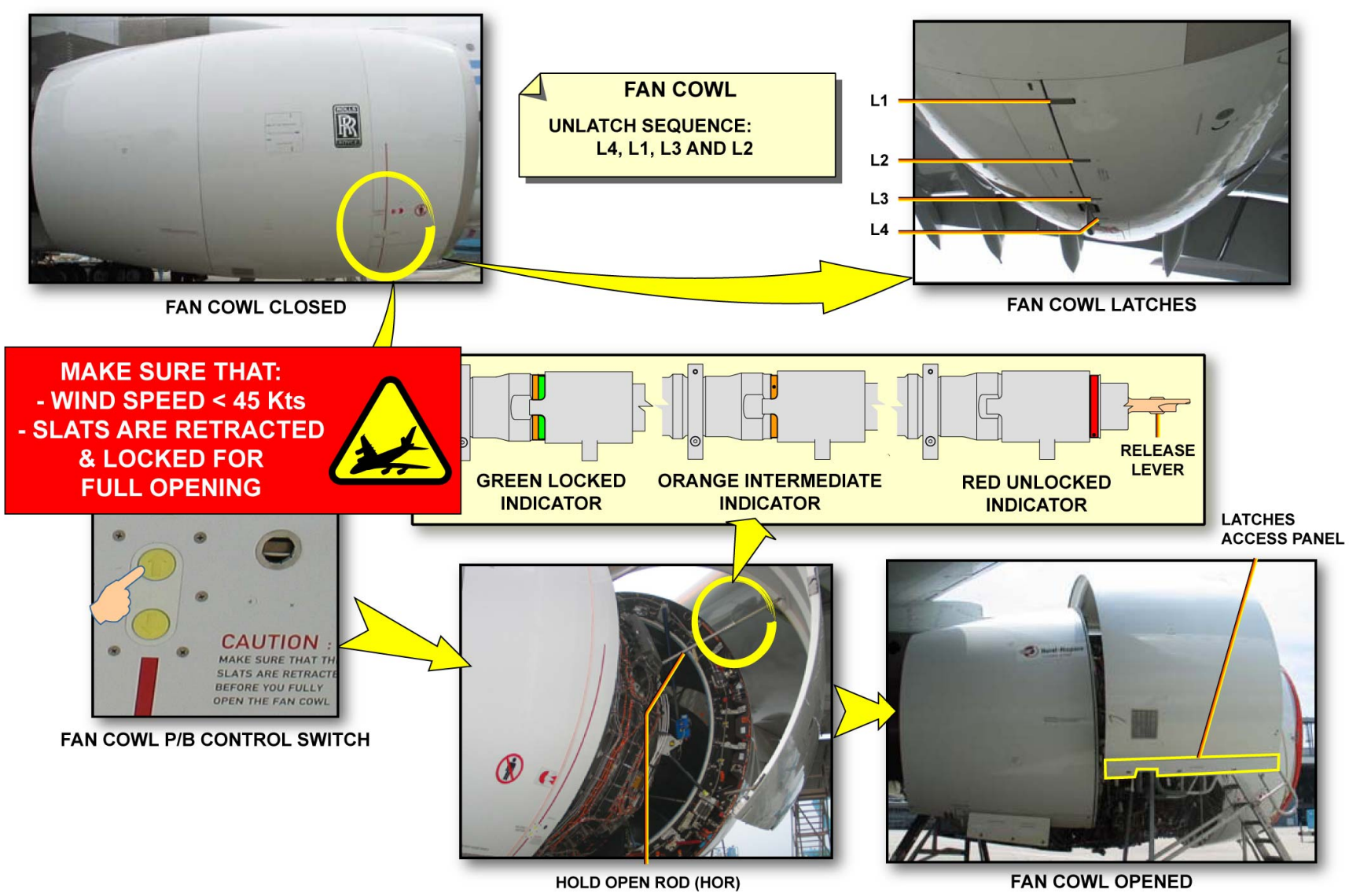
HOLD OPEN ROD (HOR)

LATCHES ACCESS PANEL



FAN COWL OPENED

FAN COWL - OPENING



FAN COWL - OPENING

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ENGINE COWLING DESCRIPTION (2)

Fan Cowl (continued)

Closing

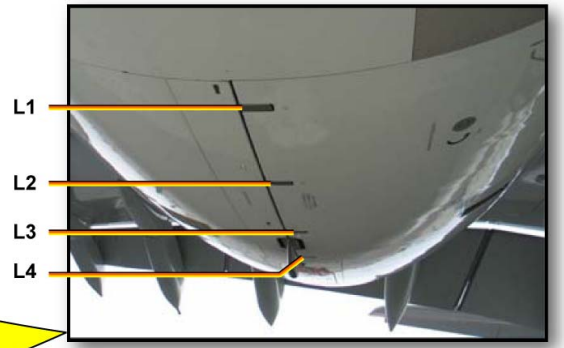
At the end of maintenance tasks on the engine, the fan cowl doors have to be closed to put the aircraft back into operation. First of all, the maintenance personnel must push the UP switch momentarily and operate the release lever on the HOR to manually unlock it. When the HOR is unlocked, the red indicator is visible. Then he has to push and hold the DOWN switch until the fan cowl door closes completely.
The locking of the four latches is done in a defined sequence:
- L2 first,
- L3,
- L1,
- and L4 at the end.

Once the latches are locked, the latch access panel has to be closed.

FAN COWL CLOSED

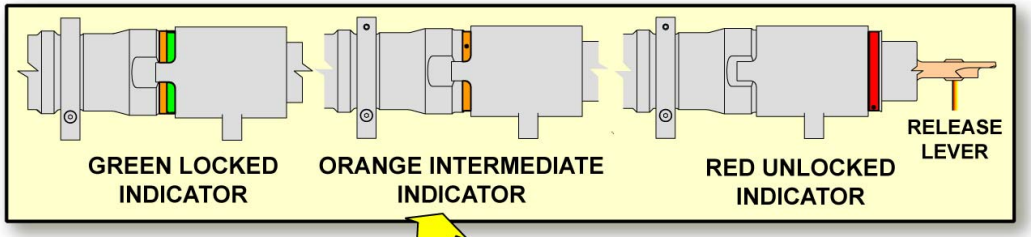
FAN COWL

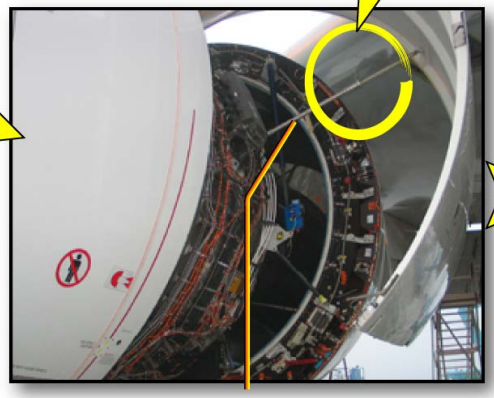
LATCH SEQUENCE:
L2, L3, L1 AND L4



FAN COWL LATCHES

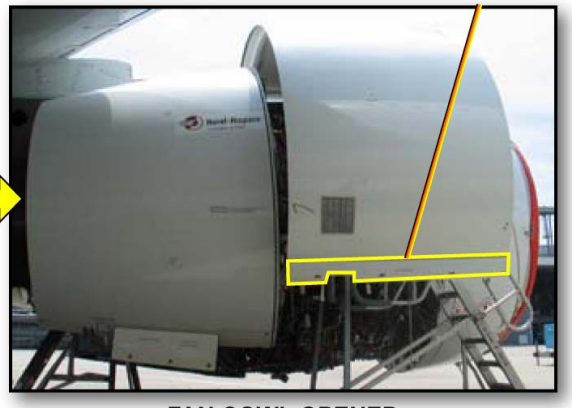
FAN COWL P/B CONTROL SWITCH





HOLD OPEN ROD (HOR)

LATCHES ACCESS PANEL



FAN COWL OPENED

FAN COWL - CLOSING

ENGINE COWLING DESCRIPTION (2)

Fan Exhaust Cowl/Thrust Reverser Cowl

Opening

The fan exhaust cowl doors can be opened for maintenance purposes on the engine. The unlatching sequence is carried out from the latch access door and the latches all installed at the bottom of the fan exhaust cowl. Unlocking of these latches is done in a defined sequence:
- the latch L1 is opened first by pulling the lock trigger and the handle to the down position,
- the latch L6.2,
- the latch L6.1 handle has to be fully open,

NOTE: A push/pull cable connects the latch L6.1 to the latch L7. When you unlatch the latch L6.1, you unlatch the latch L7 at the same time.

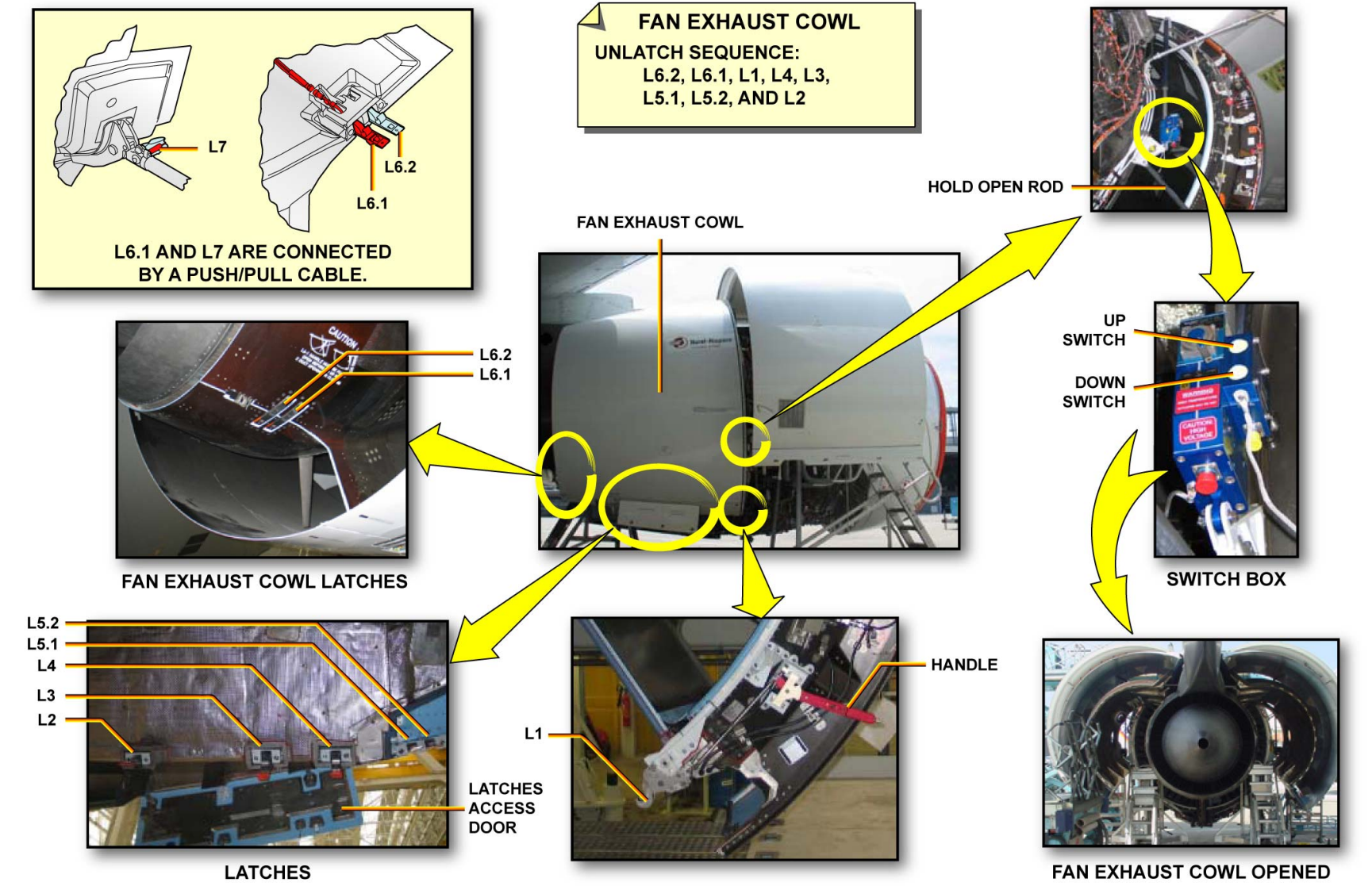
- the latch L5.2
- the latch L5.1,
- the latch L4,
- the latch L3,
- the latch L2.

Once the fan exhaust cowl doors are unlocked, the opening is done from the opening actuator switch box installed directly on the opening actuator. There is one switch box per side. The maintenance personnel must push the UP switch until the fan exhaust cowl door is opened and the HOR is locked. When the HOR is locked, the green stripe is visible. Then the maintenance personnel must push the DOWN switch to hold the exhaust cowl on the HOR. The fan exhaust cowl doors have two open positions:
- initial position of 35 degrees,
- full open position of 45 degrees.

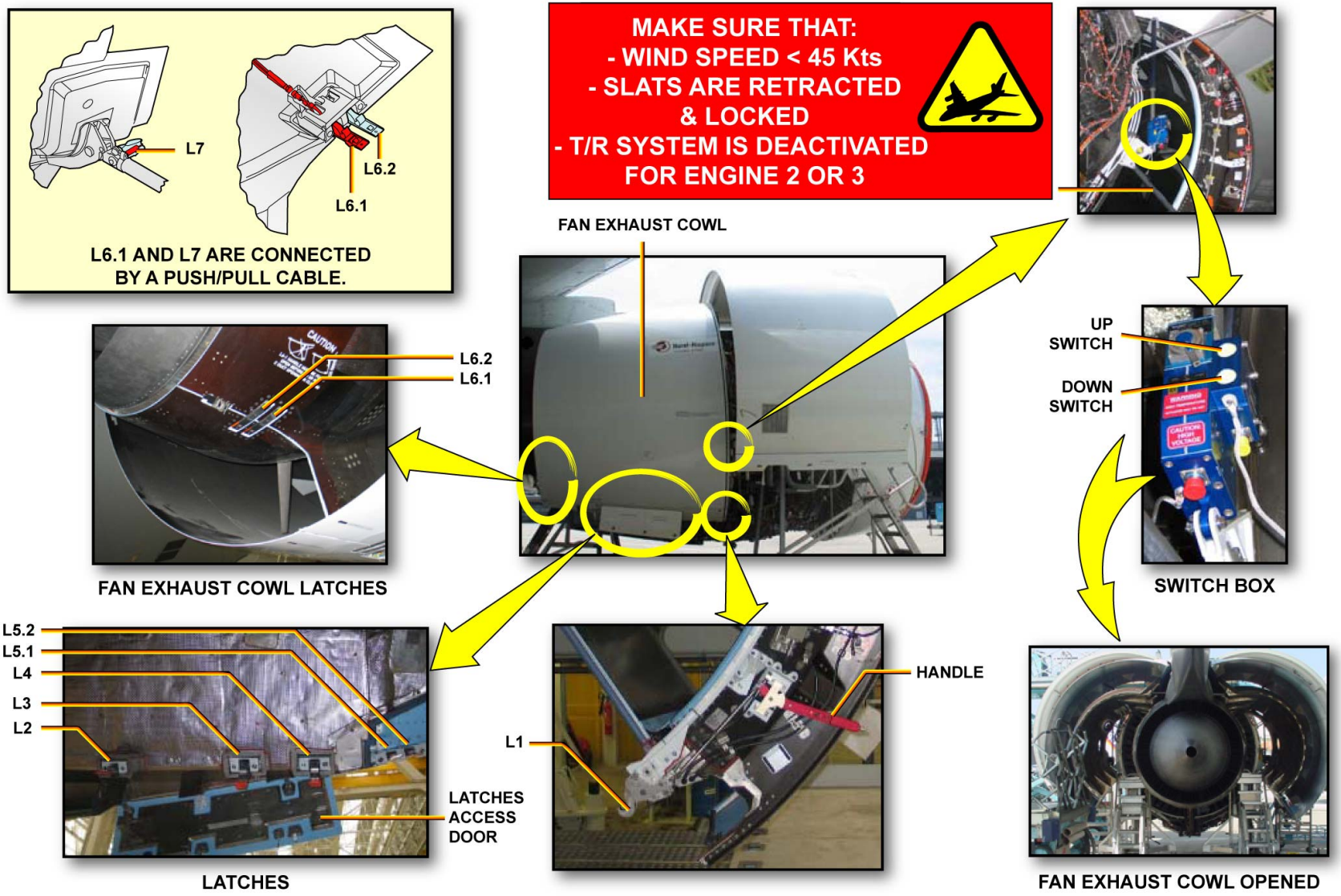
NOTE: To open the cowl up to 45 degrees, it must be open up to 35 degrees before.

Human factor points:

CAUTION: - MAKE SURE THAT THE WIND SPEED CONDITIONS ARE NOT MORE THAN 45 KNOTS.
- BEFORE OPENING THE FAN EXHAUST COWLS, MAKE SURE THAT SLATS ARE RETRACTED AND THAT THEY CANNOT MOVE, TO PREVENT FROM POSSIBLE INTERFERENCES.
- BEFORE OPENING THE FAN EXHAUST COWLS OF INBOARD ENGINES (2 OR 3), MAKE SURE THAT THE THRUST REVERSER SYSTEM HAS BEEN DEACTIVATED FOR MAINTENANCE.



FAN EXHAUST COWL/THRUST REVERSER COWL - OPENING



FAN EXHAUST COWL/THRUST REVERSER COWL - OPENING

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ENGINE COWLING DESCRIPTION (2)

Fan Exhaust Cowl/Thrust Reverser Cowl (continued)

Closing

At the end of maintenance tasks on the engine, the fan exhaust cowl doors have to be closed to put the aircraft back into operation. First of all, the maintenance personnel must push the UP switch to unload the HORs. The HOR is then unlocked and in this case, the red stripe is visible. The DOWN switch must be pushed and held until the fan exhaust cowl door closes completely.

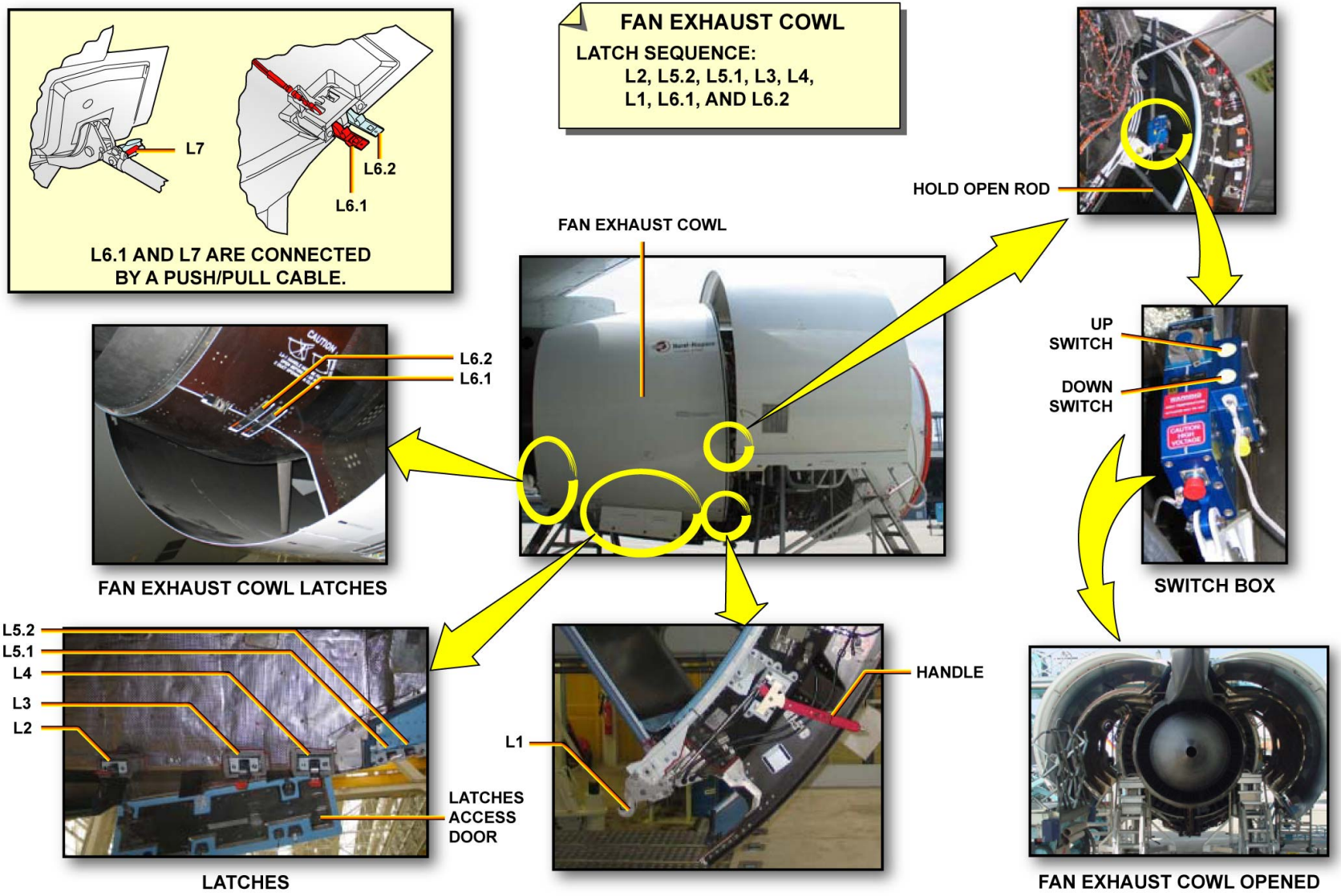
NOTE: You cannot close the cowl from the 45 degrees position to the 35 degrees position directly. It is necessary to fully close the cowl before opening it to the 35 degrees position.

The locking of these latches is done in a defined sequence:
- the latch L2 first,
- the latch L3,
- the latch L4,
- the latch L5.1,
- the latch L5.2,
- the latch L6.1 handle has to be fully closed,

NOTE: A push/pull cable connects the latch L6.1 to the latch L7. When you latch the latch L6.1, you latch the latch L7 at the same time.

- the latch L6.2,
- and at the end, the latch L1 is closed by pulling the lock trigger and the handle upward.

Once the latches are locked, the latch access door has to be closed.



FAN EXHAUST COWL/THRUST REVERSER COWL - CLOSING

ENGINE COWLING DESCRIPTION (2)

Fan Exhaust Cowl/Thrust Reverser Cowl (continued)

Specific Latch for Inboard Engines

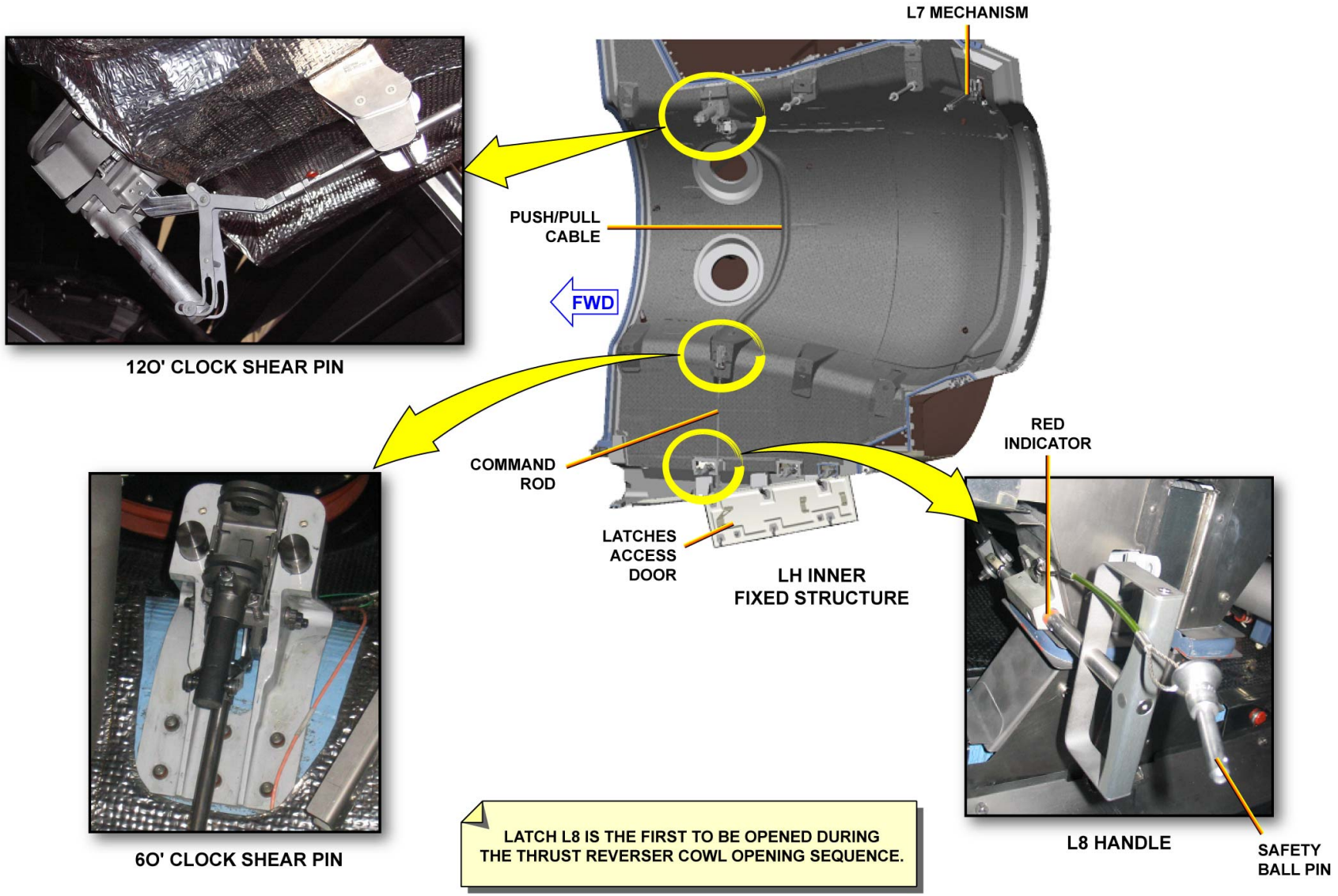
In addition, the two fixed halves of the thrust reverser structures for the inboard engines are connected together by an eighth latch L8. The latch L8 is composed of a telescopic locking system permanently connected to the LH structure at 12 o'clock and a pin latch at 6 o'clock position. A handle controls this latch, and locks/unlocks simultaneously the 6 o'clock pin latch via a command rod and the 12 o'clock latch. The 12 o'clock latch is linked to the 6 o'clock pin latch by the push/pull cable.

To open the thrust reverser cowls, you must:

- remove the safety pin from the guide support bracket of the handle,
- pull the handle until the red strip becomes visible to unlock the latch L8,
- re-install the safety pin into the guide support bracket of the handle.

To close the cowls, you must make sure that the latch L8 returned correctly in its stored position. You must also secure it by re-installing the safety ball pin.

NOTE: L8 is the first latch to be opened for the opening sequence of the fan exhaust cowl on the inboard engines.



FAN EXHAUST COWL/THRUST REVERSER COWL - SPECIFIC LATCH FOR INBOARD ENGINES

L1W06161 - L0KT0T0 - LM7RDTLEVEL0201

ENGINE COWLING DESCRIPTION (2)

Fan Exhaust Cowl/Thrust Reverser Cowl (continued)

Manual Opening/Closing

Each fan exhaust cowl/thrust reverser cowl is equipped with an opening actuator, which has a Manual Drive Unit (MDU). This MDU can be used for the opening/closing of the fan exhaust cowl/thrust reverser cowl when the electrical power is off, or in case of failure of the electrical functions in the cowl opening system. The fan exhaust cowl/thrust reverser cowl can be open manually to 35 or 45 degrees. To open the fan exhaust cowl/thrust reverser cowl manually, you must:
- turn the MDU to the opened position,
- install the torque wrench 3/8 inches in the opening actuator,
- turn the torque wrench clockwise to open the fan exhaust cowl/thrust reverser cowl to the 35 degrees position. You must stop turning when the HOR has passed the locked position.

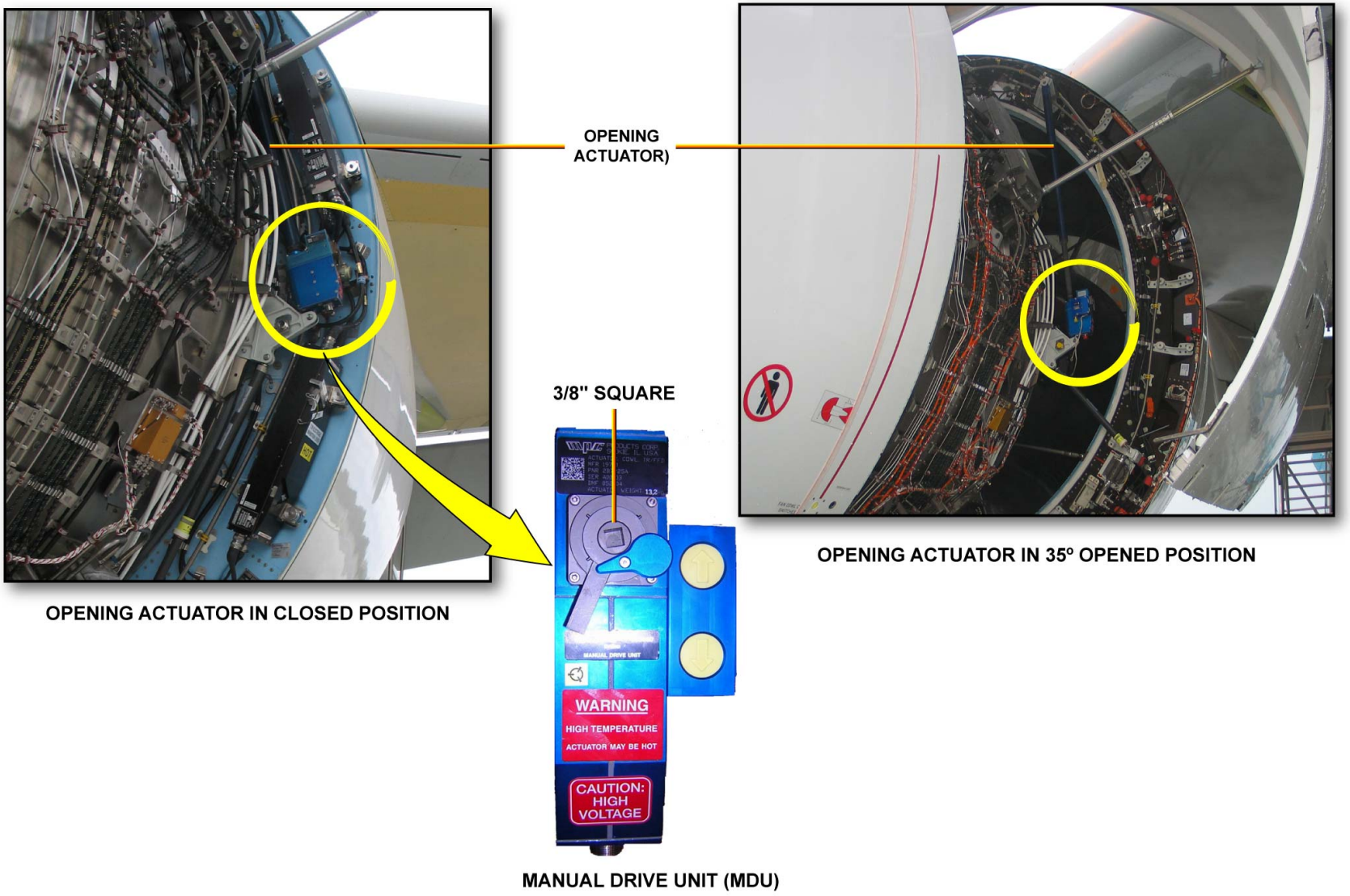
NOTE: The HOR makes a rattling noise at the locked position.
- remove the manual wrench when the HOR rod is locked and turn the MDU level in full closing position in order to release the load directly on the HOR.
- turn the MDU lever in the opening position again and insert the red flag.

NOTE: The HOR locking sleeve must slide to show the green stripe (locked position) and hide the red stripe.

Human factor points:

WARNING: LOCK THE MANUAL DRIVE UNIT LEVER AND BE SURE THE HOLD OPEN ROD IS CORRECTLY LOCKED BEFORE ANY MAINTENANCE OPERATION UNDER THE FAN EXHAUST COWL OR THRUST REVERSER COWL.

CAUTION: - IF POWERED TOOLS ARE USED, ONLY USE POWERED TOOLS WITH A TORQUE LIMITER TO MAXIMUM VALUE 89 IN.LBS (10 N.M).
- TURN THE TORQUE WRENCH SLOWLY WHEN THE HOLD OPEN ROD IS NEAR THE LOCKED POSITION TO PREVENT DAMAGE TO THE HOLD OPEN ROD AND TO THE THRUST REVERSER STRUCTURE.

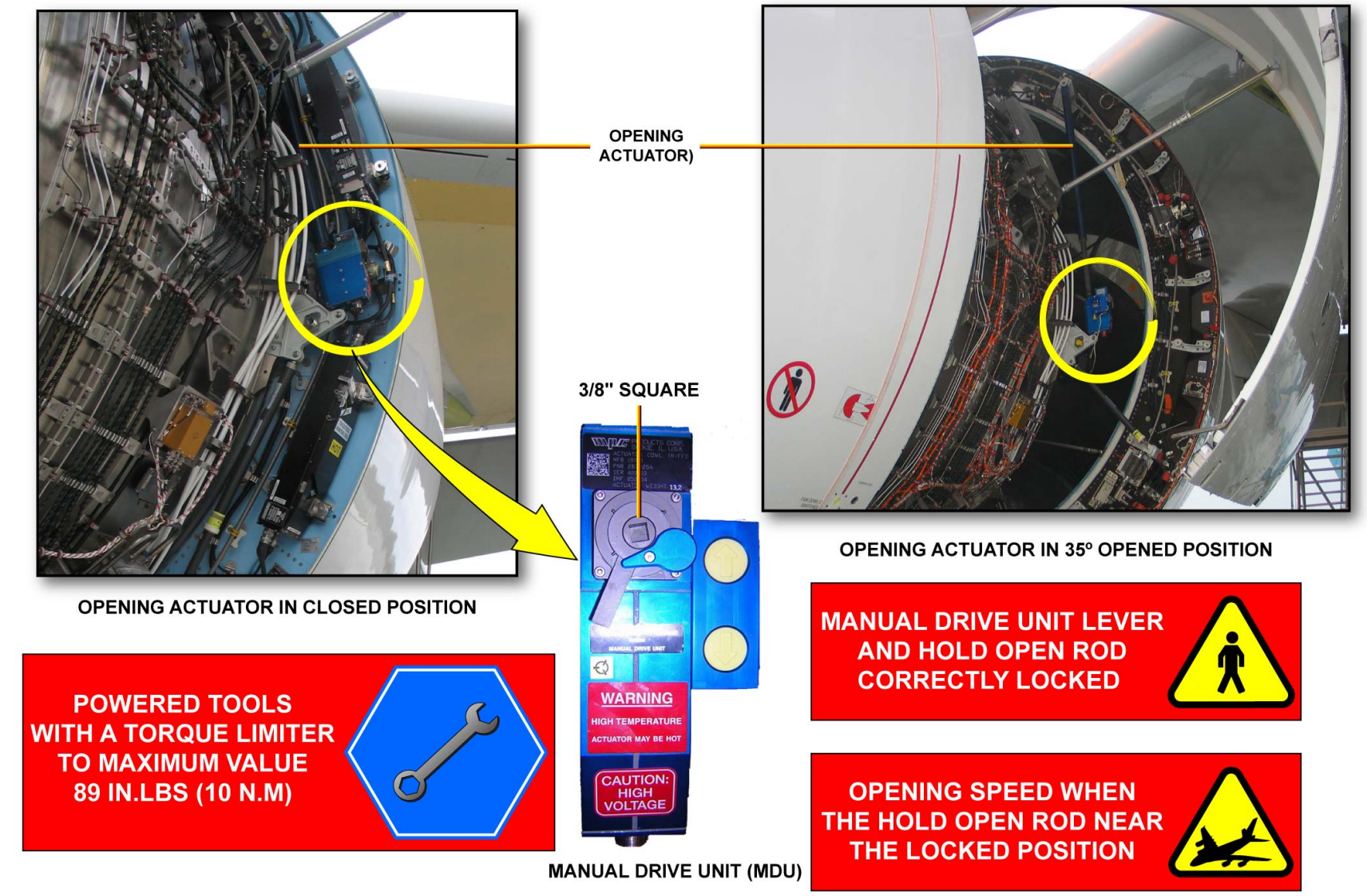


OPENING ACTUATOR IN CLOSED POSITION

OPENING ACTUATOR IN 35º OPENED POSITION

MANUAL DRIVE UNIT (MDU)

FAN EXHAUST COWL/THRUST REVERSER COWL - MANUAL OPENING/CLOSING



FAN EXHAUST COWL/THRUST REVERSER COWL - MANUAL OPENING/CLOSING

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POWERPLANT & COWLING COMPONENT LOCATION (2)

Cowl Door Components - A/C Zone 400

- **Fan Cowls - ENG 1, 2, 3, 4**
- **Fan Exhaust Cowls - ENG 1 & 4**
- **Thrust Reverser Cowls ENG 2 & 3**

Powerplant Components - A/C Zone 400

- **Engine Accessory Gearbox**
- **Fan Case LH Side**
- **Fan Case RH Side**

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ENGINE SYSTEM DESCRIPTION (2)

FADEC

General Architecture

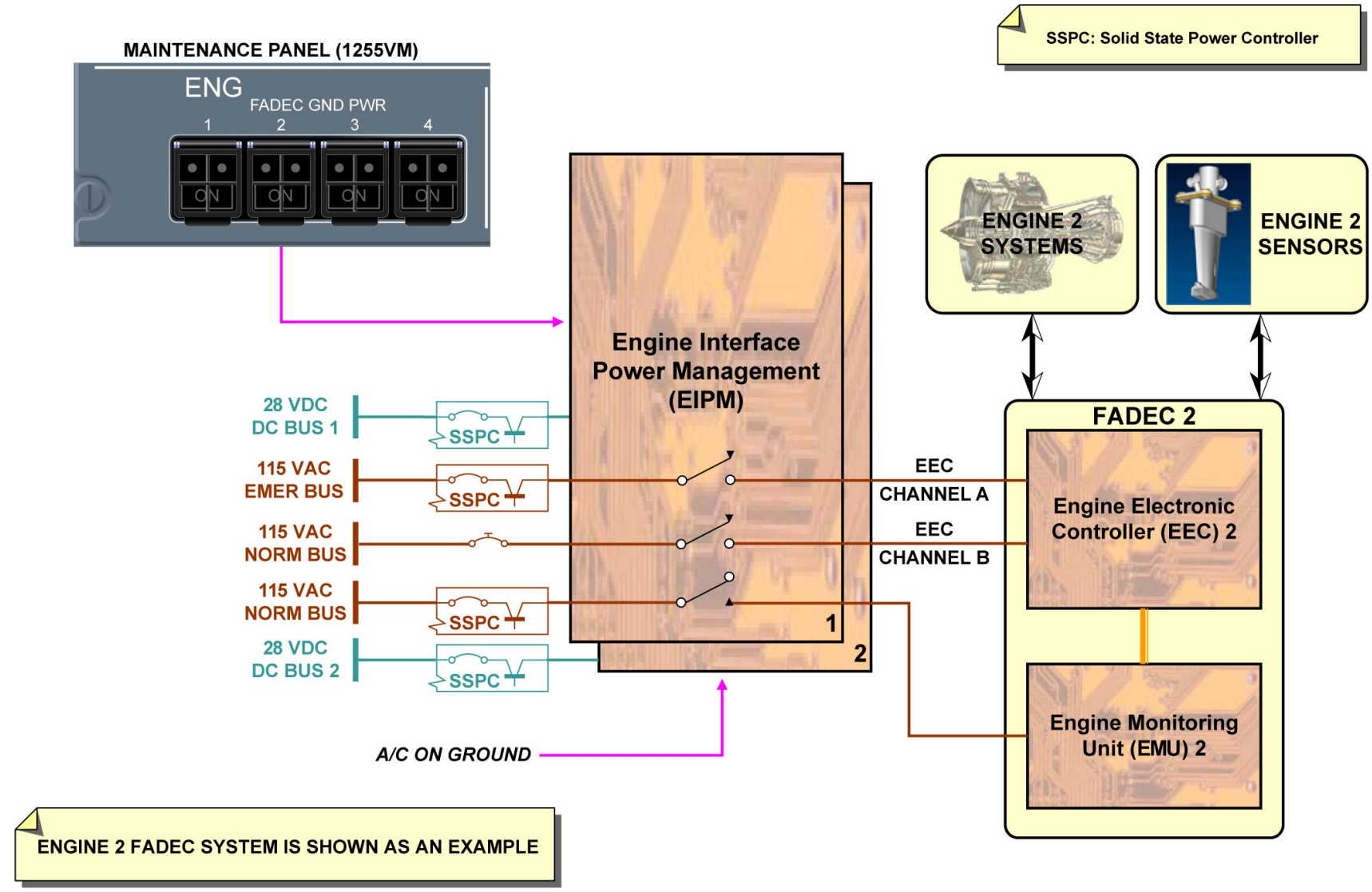
The Full Authority Digital Engine Control (FADEC) system accepts signals from the various aircraft sub-systems and the engine sensors. These signals allow the FADEC to provide all the necessary features to control the engine, command stow and deploy of the thrust reverser and to provide engine data to the aircraft.
The system is composed of:
- the Engine Electronic Controller (EEC),
- the Engine Monitoring Unit (EMU).

The EEC is the FADEC central unit, which is a full authority, dual channel, digital electronic control unit, interfacing with the aircraft and engine control system components.
The EMU monitors engine vibration and engines condition. The inputs received from the EEC and various engine and environmental sensors are analyzed by the EMU, which generates a report on the engines condition and identifies irregular engine data.
For maintenance purposes, the FADEC system can be energized from the ENGine FADEC GrouND PoWeR P/BSW located on the overhead maintenance panel. The Engine Interface Power Management (EIPM) computer achieves the power supply command.

Supply on Ground

The power supply of the FADEC systems is controlled by the EIPM computer, which supplies the electrical power from the aircraft to the FADEC systems. When the engine is not running, the EEC gets its 115 VAC power supply from the AC NORM BUS and the AC EMER BUS. The EMU is supplied in 115 VAC from the AC NORM BUS. The EIPM computer 1(2) itself is supplied in 28 VDC from the DC BUS 1(2).
During on-ground maintenance operations, setting the FADEC GND PWR P/BSW to ON allows the EEC to be energized for 5 minutes.

The EEC will stay permanently energized if the EEC INTERACTIVE mode is set through the Central Maintenance System (CMS) during the 5 minutes. Releasing out the FADEC GND PWR P/BSW cuts the EEC power supply.



FADEC - GENERAL ARCHITECTURE & SUPPLY ON GROUND

ENGINE SYSTEM DESCRIPTION (2)

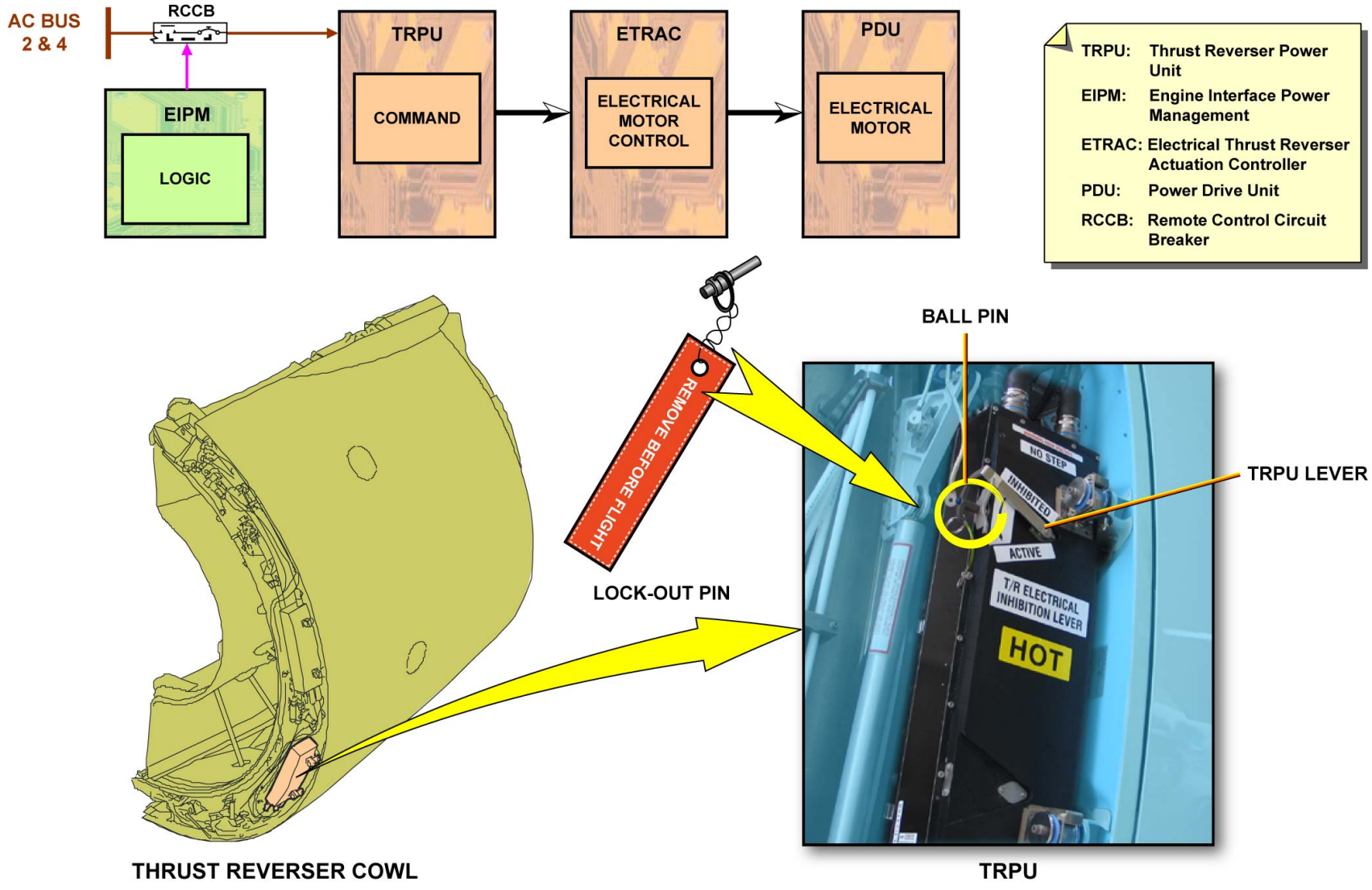
Thrust Reverser

Power Inhibition for Maintenance

To make sure that the thrust reverser system is unserviceable for maintenance, the Thrust Reverser Power Unit (TRPU) has to be deactivated by inhibiting the power supply of the thrust reverser system. The TRPUs are installed on the inboard engines only, under the LH fan cowl door.

In normal operation, the TRPU is powered with 115 VAC 3 phase by the EIPM logic. The TRPU then energizes the Electronic Thrust Reverser Actuation Controller (ETRAC), which will supply the Power Drive Unit (PDU) to control the actuators.

So the power supply inhibition requires the removal of the ball pin from the TRPU and to turn the TRPU lever to the "INHIBITED" position. The ball pin must be re-installed. When the TRPU lever is in the "INHIBITED" position, the ETRAC is no longer supplied. A lock-out pin with the "REMOVE BEFORE FLIGHT" flag must be installed in the TRPU hole.



THRUST REVERSER - POWER INHIBITION FOR MAINTENANCE

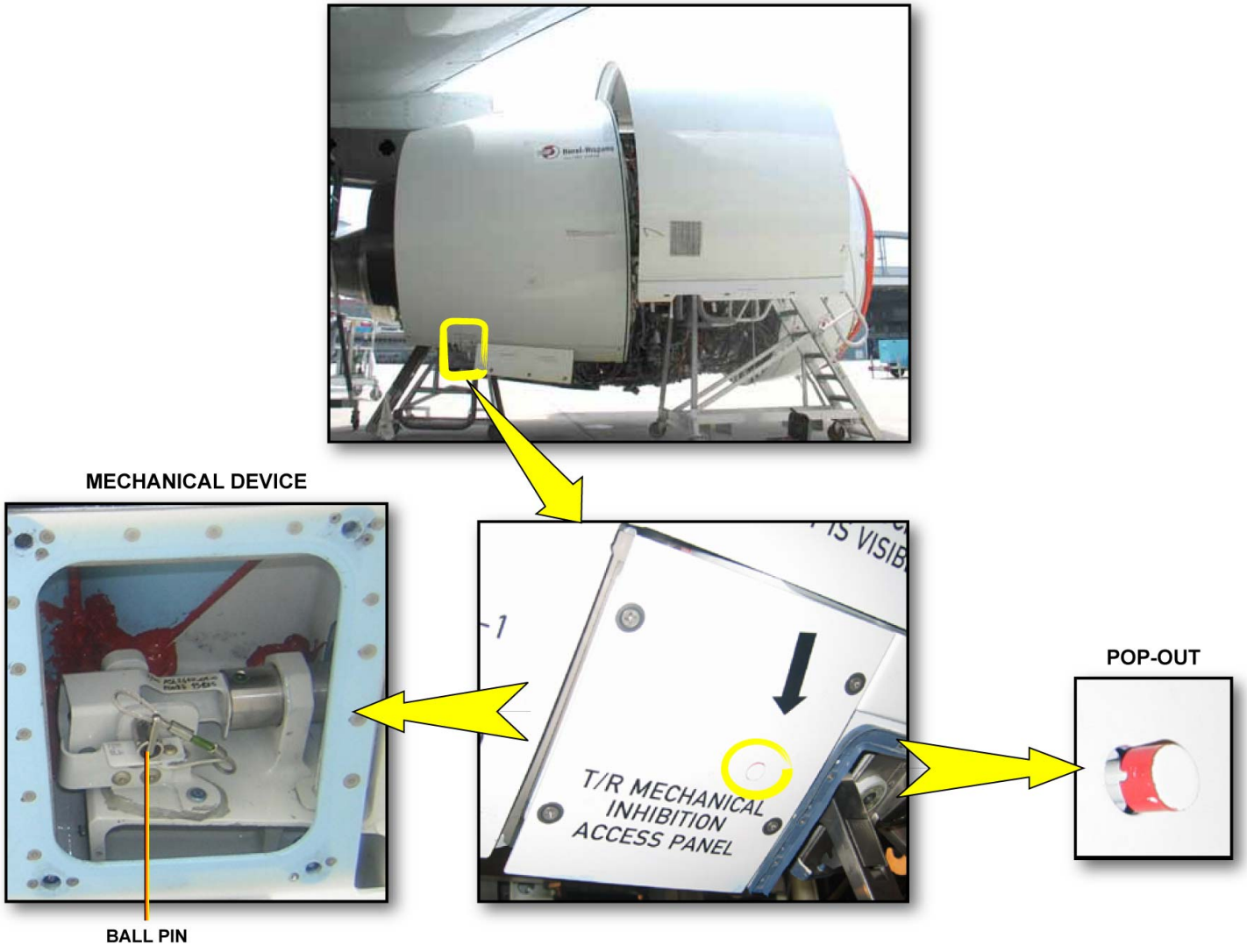
ENGINE SYSTEM DESCRIPTION (2)

Thrust Reverser (continued)

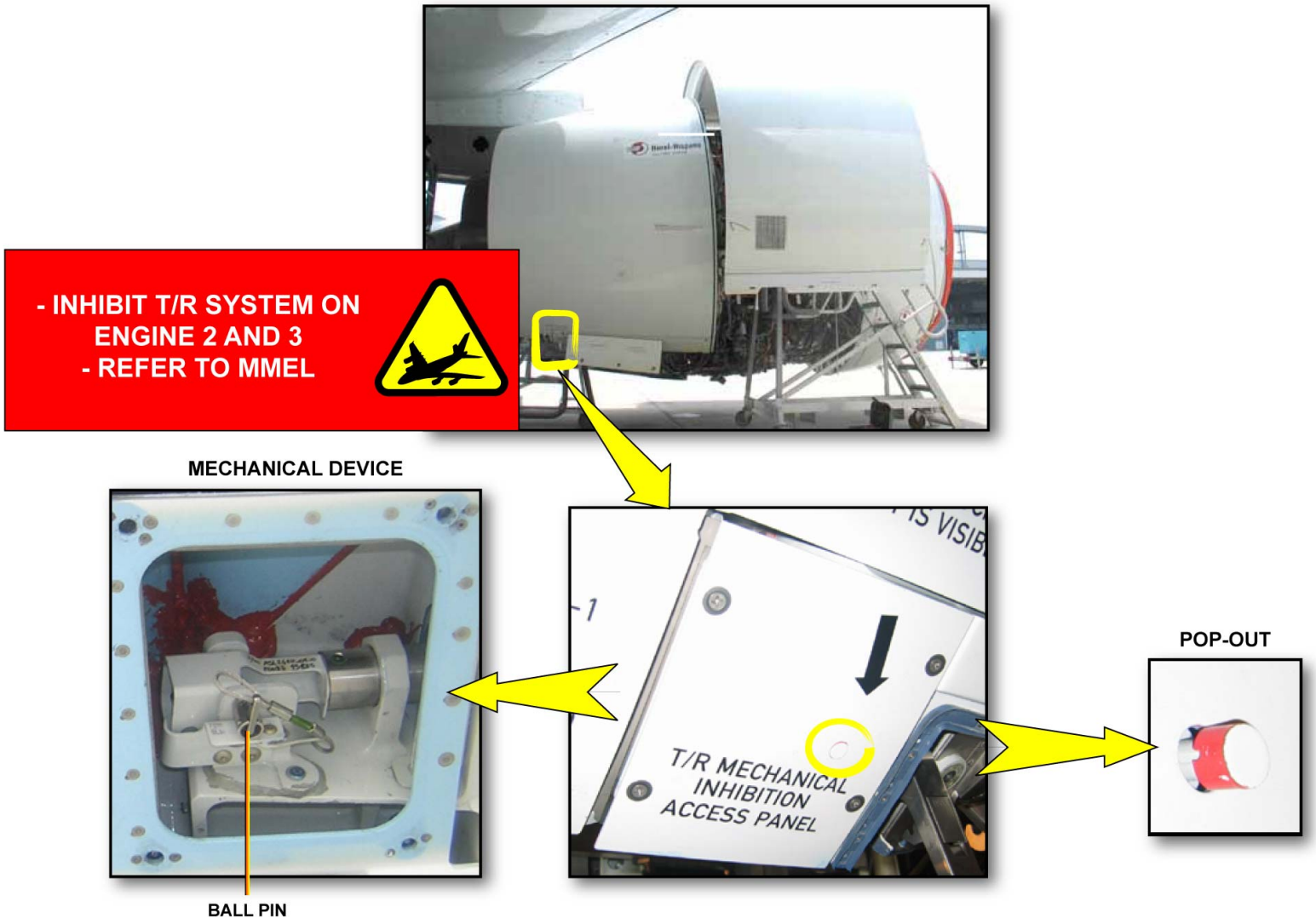
Power Inhibition and Mechanical Inhibition Before Flight

To make sure that the thrust reverser system is unserviceable for flight, the TRPU has to be electrically deactivated and the two translating cowls mechanically deactivated. The mechanical inhibition device of the thrust reverser is accessed by loosening the four captive screws on the mechanical inhibition access panel installed on the rear lower part of the thrust reverser cowls.
The mechanical inhibition requires the removal of the ball pin from the mechanical device. The mechanical device is then pushed to the "INHIBITED" position. The ball pin has to be re-installed to lock the mechanical device. When the thrust reverser system is mechanically inhibited a red pop-out is visible on the inhibition access panel.
Human factor points:

WARNING: - TO INHIBIT THE THRUST REVERSER SYSTEM YOU MUST INHIBIT IT ON ENGINE 2 AND 3,
- REFER TO MMEL.



THRUST REVERSER - POWER INHIBITION AND MECHANICAL INHIBITION BEFORE FLIGHT



THRUST REVERSER - POWER INHIBITION AND MECHANICAL INHIBITION BEFORE FLIGHT

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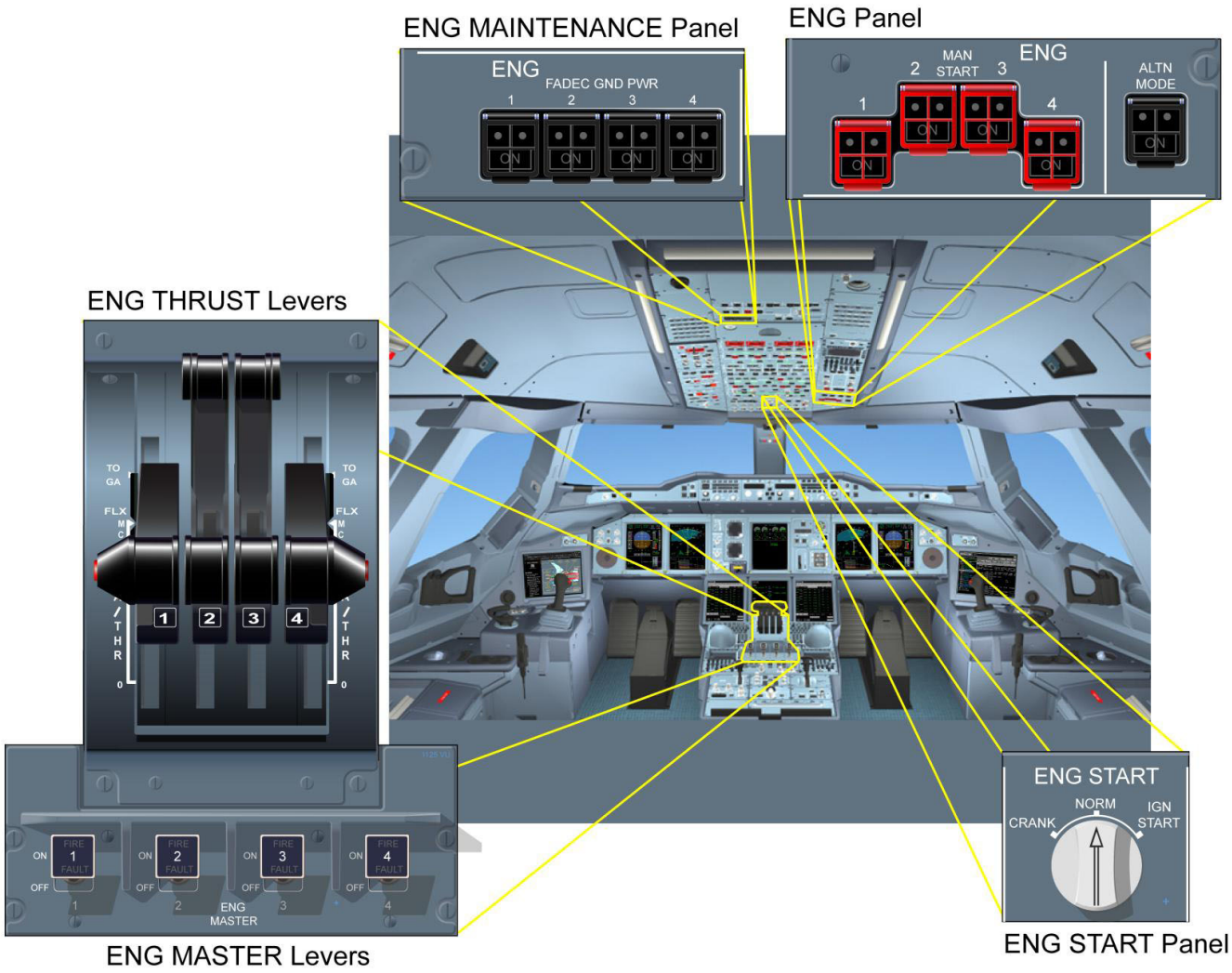
ENGINE SYSTEM OPERATION, CONTROL & INDICATING (2)

General


ENG MAINTENANCE Panel
ENG
FADEC GND PWR
1 2 3 4
ON
ENG Panel
MAN START
2 3
ENG
1 4
ON
ALTN MODE
ON
ENG THRUST Levers
TO GA
FLX MC
1 2 3 4
A/THR
ENG START
NORM
CRANK
IGN START
FIRE
FAULT
ON
OFF
ENG MASTER
ENG MASTER Levers
ENG START Panel

GENERAL

ENGINE SYSTEM OPERATION, CONTROL & INDICATING (2)

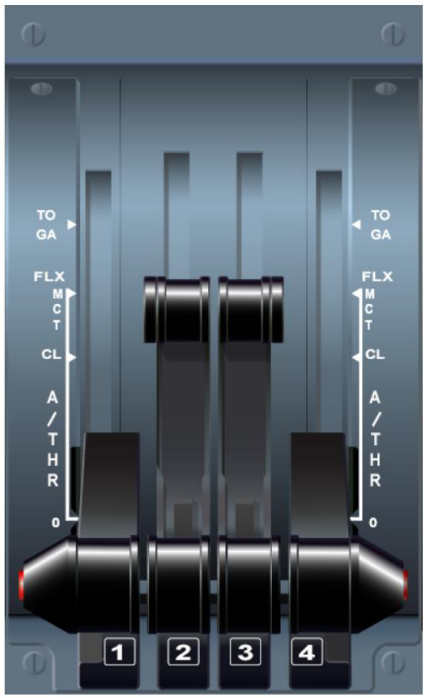
General Layout

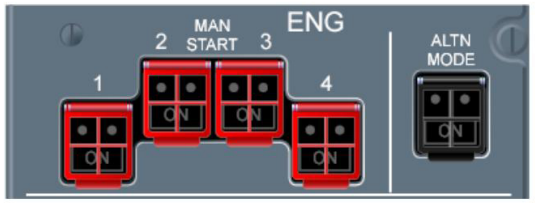
Engine Controls & Panels

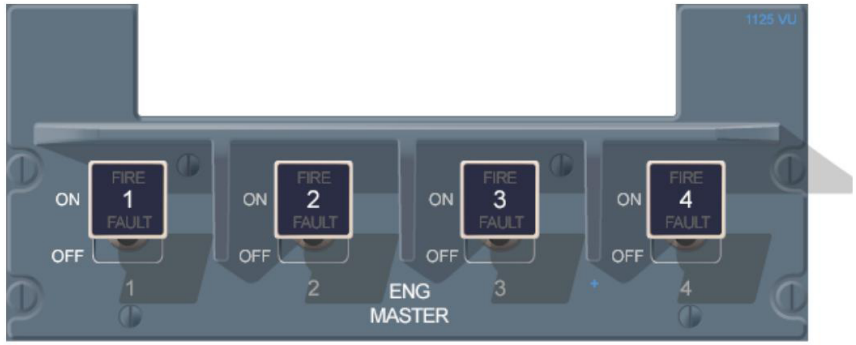
Human factor points:

WARNING: MAKE SURE THAT THRUST REVERSER LEVERS ARE IN STOWED POSITION WITH NO REVERSER SYSTEM IN OPERATION BEFORE WORKING ON ENGINE.

CAUTION: MAKE SURE THAT THE FADEC IS NOT ENERGIZED BEFORE WORKING ON ENGINE.





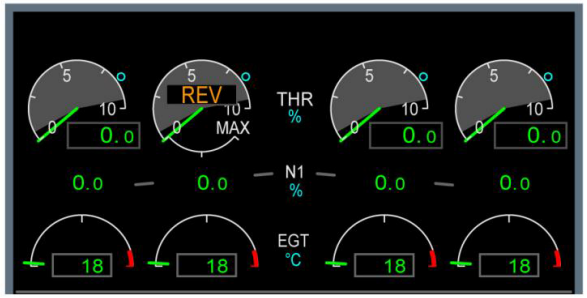


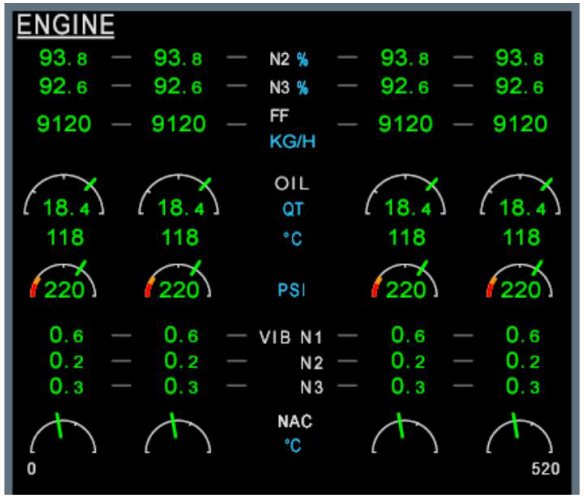
GENERAL LAYOUT - ENGINE CONTROLS & PANELS

ENGINE SYSTEM OPERATION, CONTROL & INDICATING (2)

General Layout (continued)

Indications





GENERAL LAYOUT - INDICATIONS

ENGINE SYSTEM COMPONENT LOCATION (2)

A/C Zone 122

Main Avionics Compartment

A/C Zone 400

Engine LH Fan Case

Thrust Reverser Cowl Door

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ENGINE START ASSISTANCE DESCRIPTION (2)

Ignition System Architecture

Each engine has two independent ignition systems, which give an electrical spark used to start ignition of the fuel/air mixture in the engine.
The engine starting, ignition controls are found on the following cockpit panels:
- ENGine START control panel, on the overhead control panel,
- ENG MASTER control panel, on the center pedestal,
- ENG MANual START panel, on the overhead control panel.

All these controls are linked to the Input/Output Modules (IOMs) type A. The IOMs are themselves linked to the Engine Electronic Controller (EEC) via the Avionics Data Communication Network (ADCN). This enables the EEC to control the engine starting sequences, engine cranking options and the ignition selection in response to aircraft command signals.
The ENG MASTER levers are hardwired to the EEC for reset and back-up purposes if the ADCN fails. The EEC also interfaces with the ignition units and the Starter Control Valves, in order to control and monitor their operation during the starting or cranking phases.
The Engine Interface Power Management (EIPM) maintains the power supply to the EEC and supplies the ignition system with 115 VAC.
The ignition leads transmit the electrical power from the ignition units to the igniter plugs. Throttle control lever sends an analogic signal to the EEC to enable it to compute the correct thrust to be applied.

Automatic Start

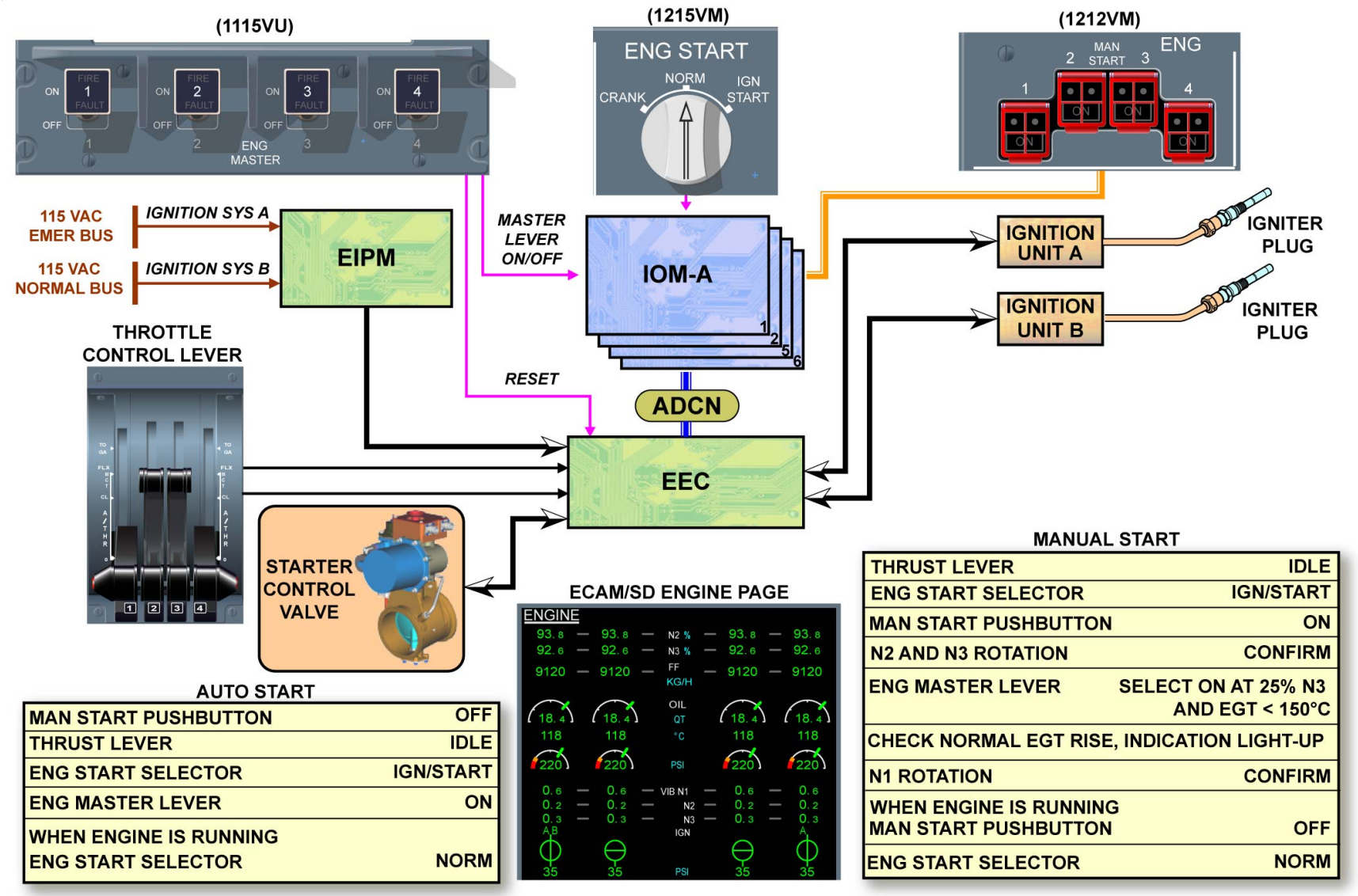
The EEC does the selection of an automatic engine start after reception of the appropriate cockpit commands. The EEC will automatically shut down the engine if the start procedure is not satisfactory.
For automatic start of the engine, the controls have to be selected as follows:
- the MAN START P/BSW on the ENG panel is off (ON legend is off),
- the thrust lever is set to the IDLE position,
- the rotary selector on the ENG START panel is set to the IGNition/START position,
- the lever on the ENG MASTER panel is set to the ON position.
- once the engine is running the ENG START rotary selector is set to NORM position.

Manual Start

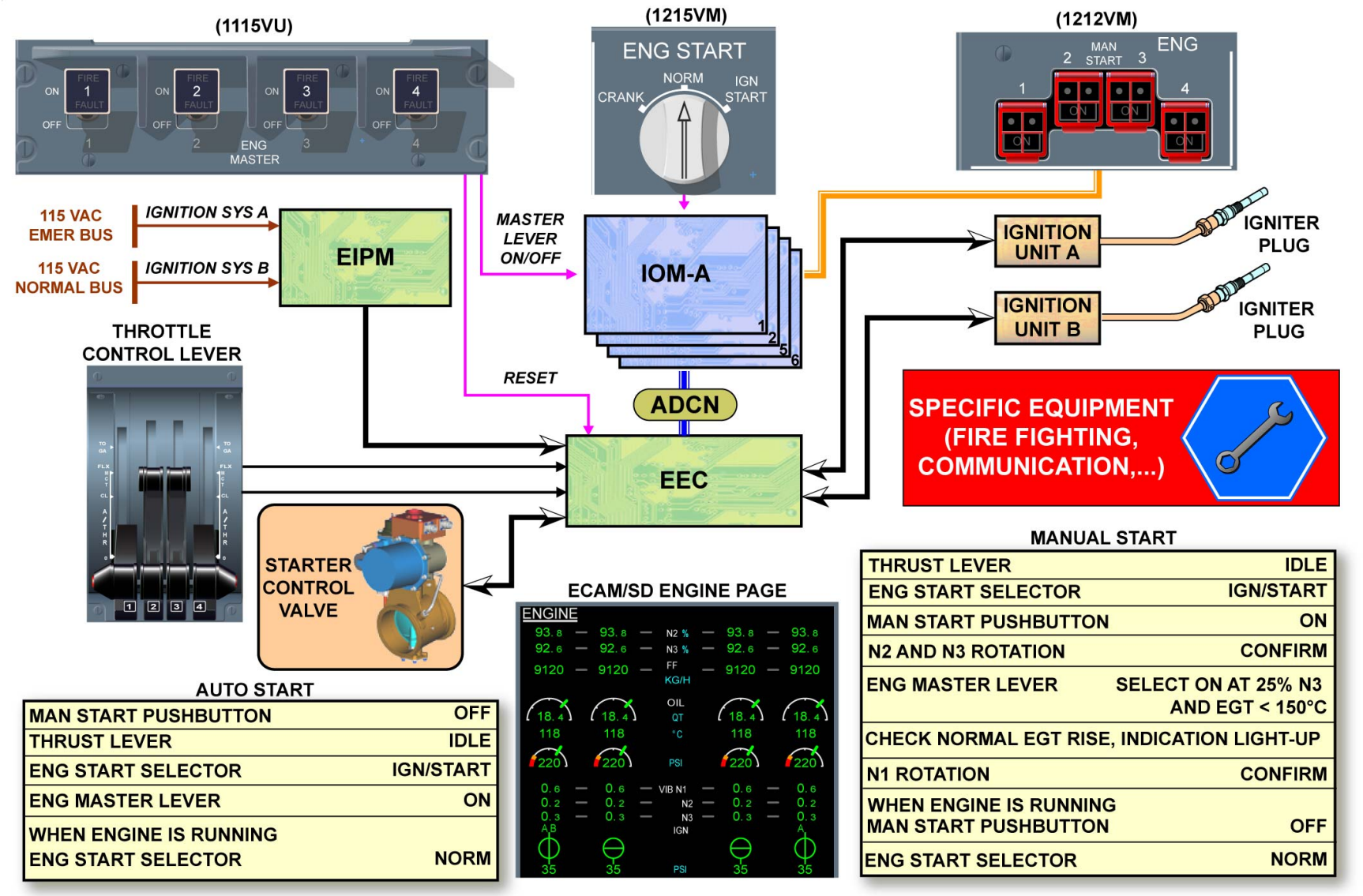
Alternatively the engine can be started manually with the flight crew or maintenance personnel in control of the start sequence. In this mode the engine starting control is under limited authority of the EEC. After reception of the appropriate cockpit commands the EEC system has a limited interaction to control the starter control valve, fuel and igniters.
For manual ground start of the engine, the controls have to be selected as follows:
- the thrust lever is set to the IDLE position,
- the rotary selector on the ENG START panel is set to the IGN/START position,
- the MAN START P/BSW on the ENG panel is set to ON,
- the applicable N2 (intermediate pressure shaft) and N3 (HP shaft) rotation speeds are monitored on the ENGINE page of the ECAM SD and the procedure continues when they are reached,
- the lever on the ENG MASTER panel is set to the ON position at 25% N3 and Exhaust Gas Temperature (EGT) less than 150°C (302°F),
- the normal EGT rise is checked on the E/WD by means of an indication light-up,
- the applicable N1 (LP compressor rotation speed) is monitored on the EWD and the procedure continues when it is reached,
- once the engine is running MAN START P/BSW goes off,
- the ENG START rotary selector is set to NORM position.

Human factor point:

WARNING: USE SPECIFIC EQUIPMENTS (FIRE FIGHTING, COMMUNICATION...).



IGNITION SYSTEM ARCHITECTURE ... MANUAL START



AUTO START

MAN START PUSHBUTTON	OFF
THRUST LEVER	IDLE
ENG START SELECTOR	IGN/START
ENG MASTER LEVER	ON
WHEN ENGINE IS RUNNING ENG START SELECTOR	NORM

MANUAL START

THRUST LEVER	IDLE
ENG START SELECTOR	IGN/START
MAN START PUSHBUTTON	ON
N2 AND N3 ROTATION	CONFIRM
ENG MASTER LEVER	SELECT ON AT 25% N3 AND EGT < 150°C
CHECK NORMAL EGT RISE, INDICATION LIGHT-UP	
N1 ROTATION	CONFIRM
WHEN ENGINE IS RUNNING MAN START PUSHBUTTON	OFF
ENG START SELECTOR	NORM

IGNITION SYSTEM ARCHITECTURE ... MANUAL START

L1W06161 - L0KT0T0 - LM7RDRLEVEL0201

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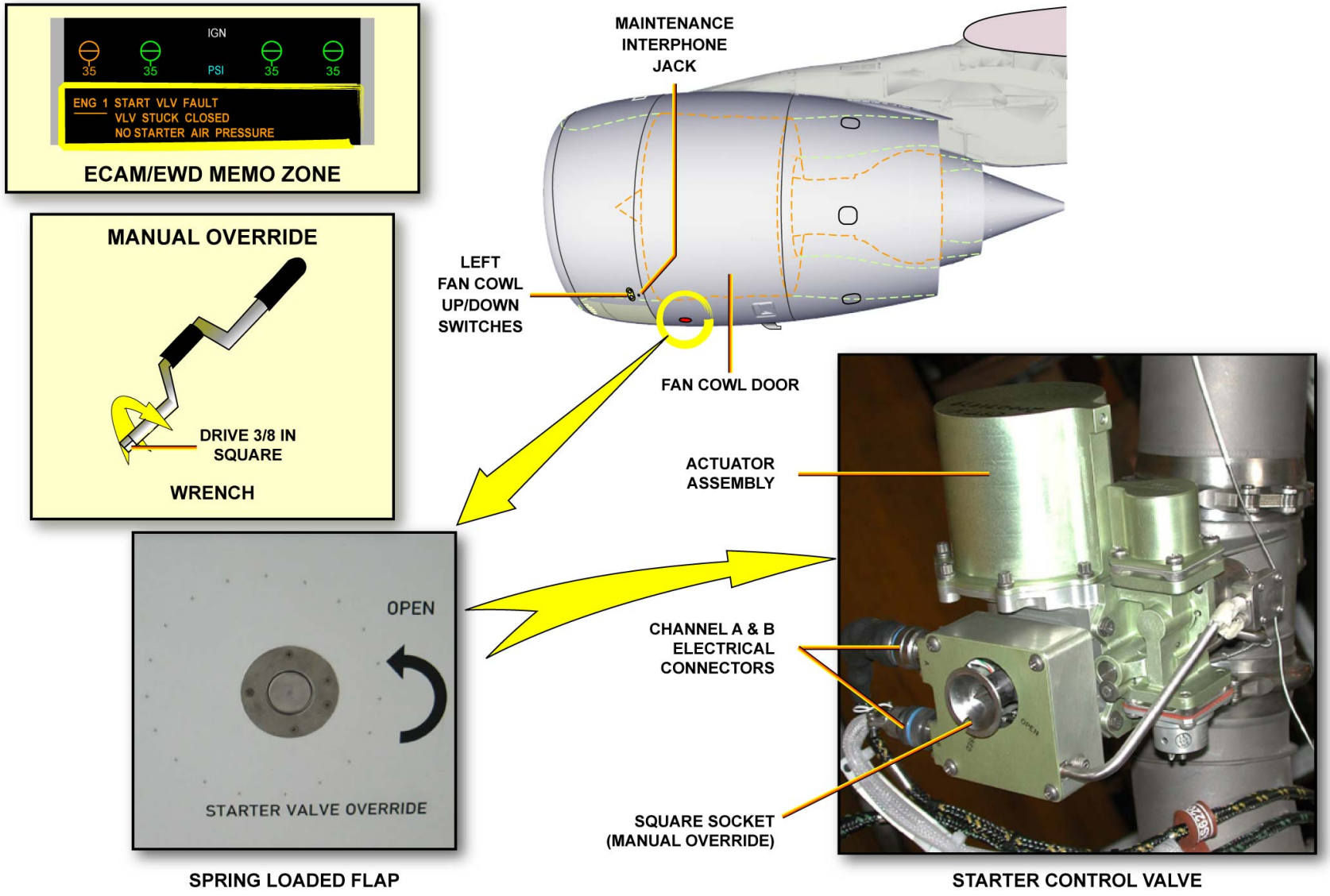
ENGINE START ASSISTANCE DESCRIPTION (2)

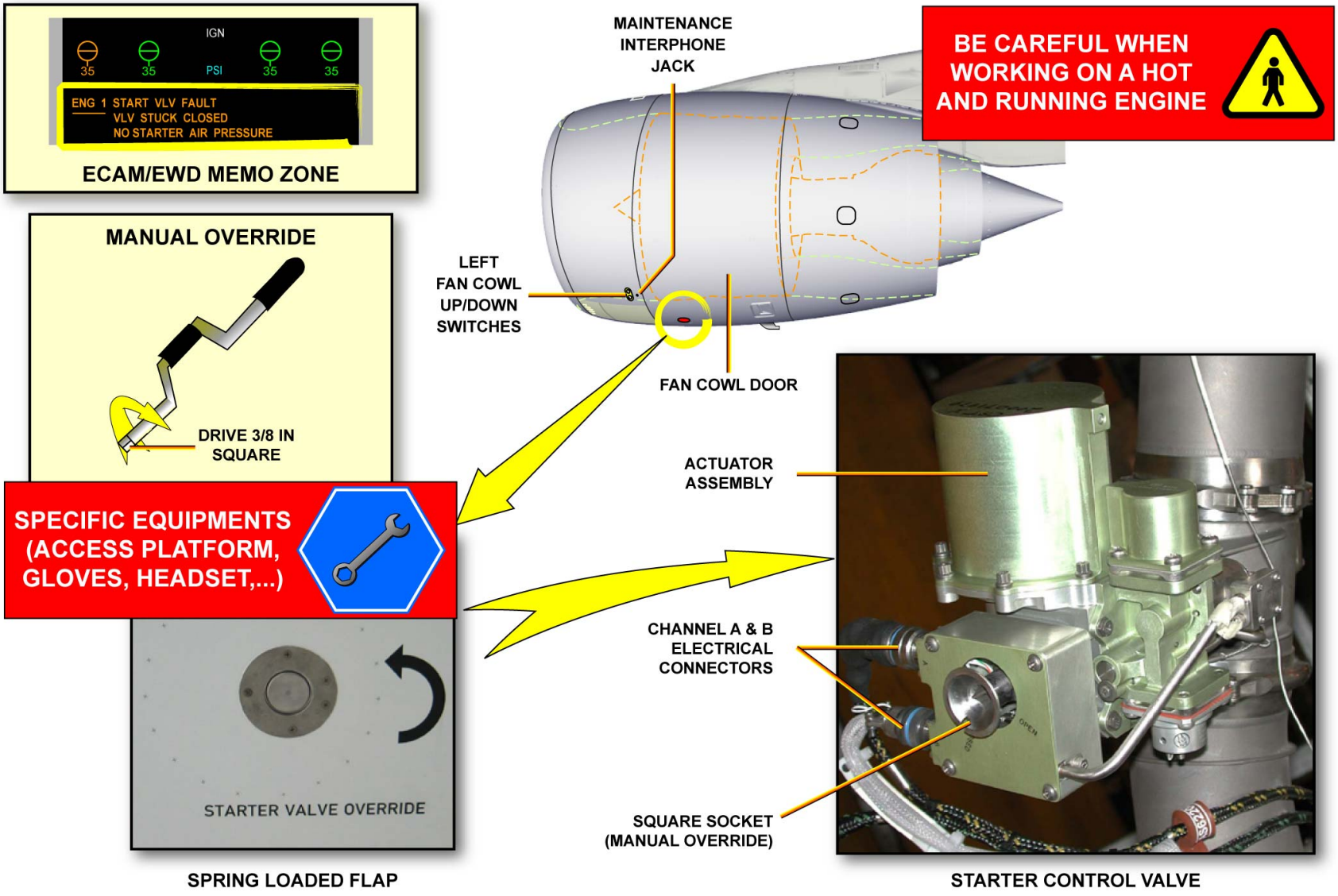
Starter Control Valve Override

The starter control valve is installed in the starter duct at the lower left side of the fan case. Normally controlled by the EEC, the starter control valve controls the flow of air to the pneumatic starter.
When the starter control valve fails to open, the START VLV FAULT message is shown on the EWD. The starter control valve can be manually open for dispatch reasons without opening the fan cowl door. Access is available through a spring-loaded flap in the fan cowl door. The manual override of the starter control valve shall be possible by applying a DRIVE 3/8-inch - SQUARE to the square socket installed on the valve.
During this operation the maintenance personnel has to stay in contact with the cockpit through the service interphone whose connection is located at the air intake cowl. Only the cockpit crew orders to open the valve, the tool has to be rotated counter clockwise until the end stop is reached. The valve is kept in this position until the cockpit crew order to close it. This order is given after 50% of N3 is reached. Rotating the tool clockwise until the end stop is reached closes the starter control valve.
Human factor points:

WARNING: - BE CAREFUL WHEN WORKING ON A HOT RUNNING ENGINE,
- USE SPECIFIC EQUIPMENTS (ACCESS PLATFORM, GLOVES, HEADSET...).



STARTER CONTROL VALVE OVERRIDE



STARTER CONTROL VALVE OVERRIDE

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ENGINE START ASSISTANCE OPS, CTL & IND (2)

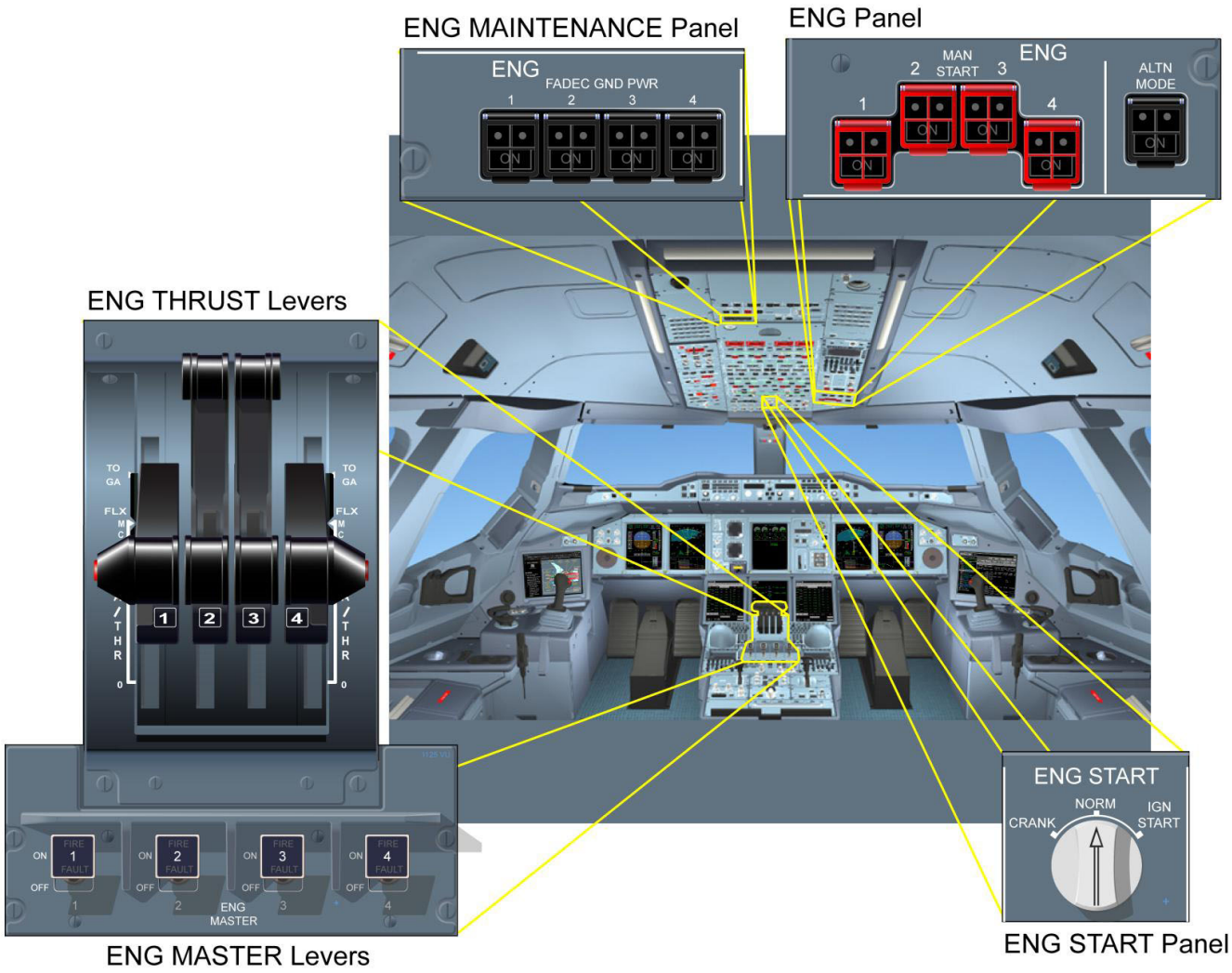
General

GENERAL

ENGINE START ASSISTANCE OPS, CTL & IND (2)

General (continued)

Engine Start Controls & Panels Location



GENERAL - ENGINE START CONTROLS & PANELS LOCATION

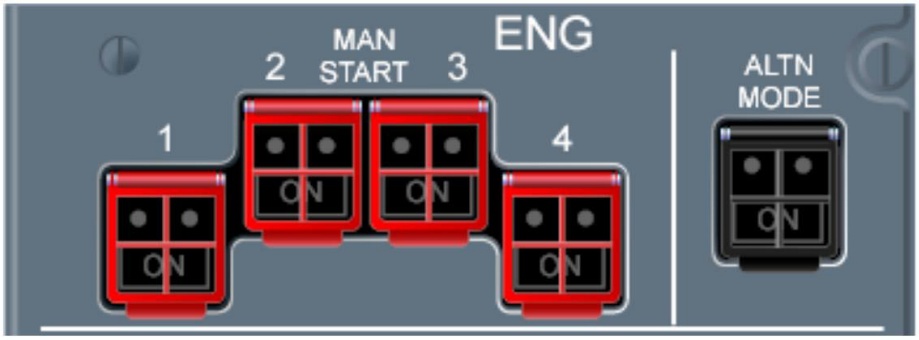
ENGINE START ASSISTANCE OPS, CTL & IND (2)

Before Engine Start Preparation

Engine Start

Normal Start Procedure

Engine Start Valve Fault



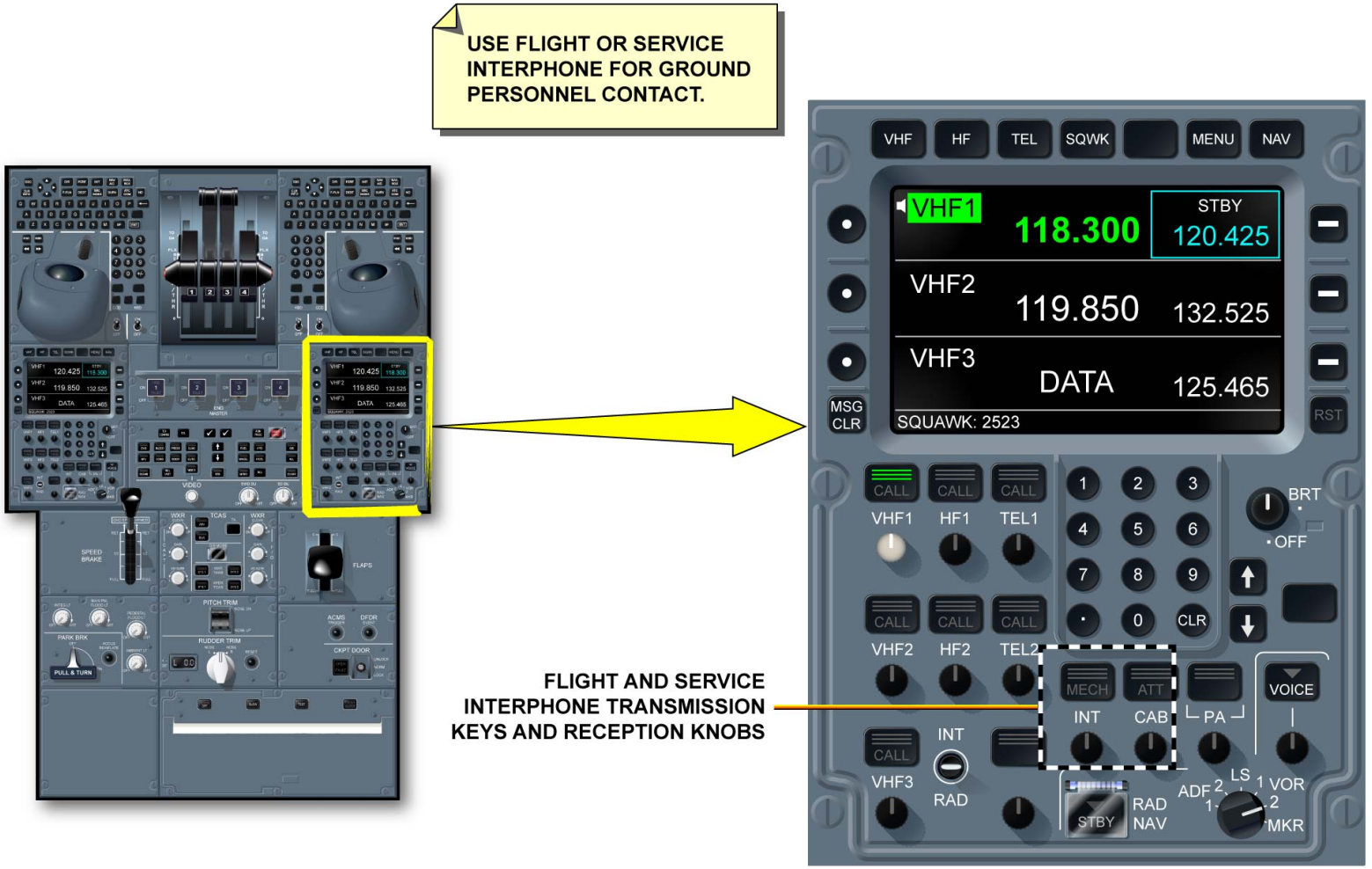
BEFORE ENGINE START PREPARATION & ENGINE START

ENGINE START ASSISTANCE OPS, CTL & IND (2)

Engine Start with Assistance

Start Procedure

Radio Management Panel



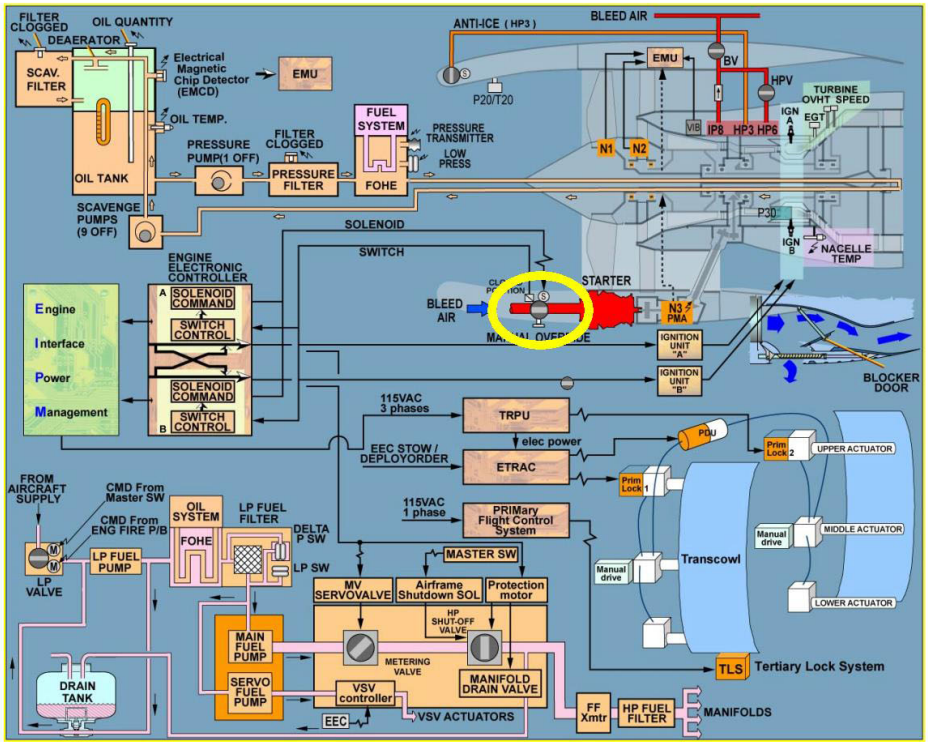
ENGINE START WITH ASSISTANCE - START PROCEDURE & RADIO MANAGEMENT PANEL

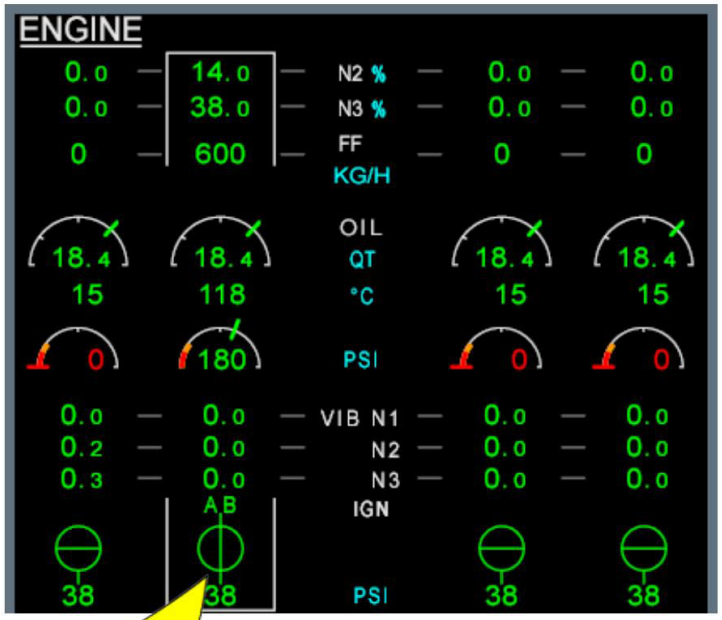
ENGINE START ASSISTANCE OPS, CTL & IND (2)

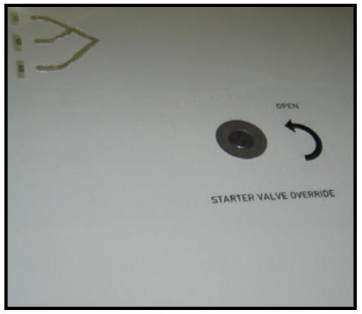
Engine Start with Assistance (continued)

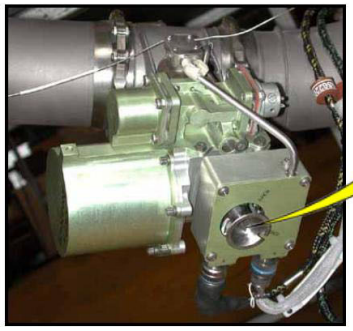
Engine Manual Start

COCKPIT CREW ORDERS TO MECHANIC, FOR OPENING OF THE STARTER CONTROL VALVE

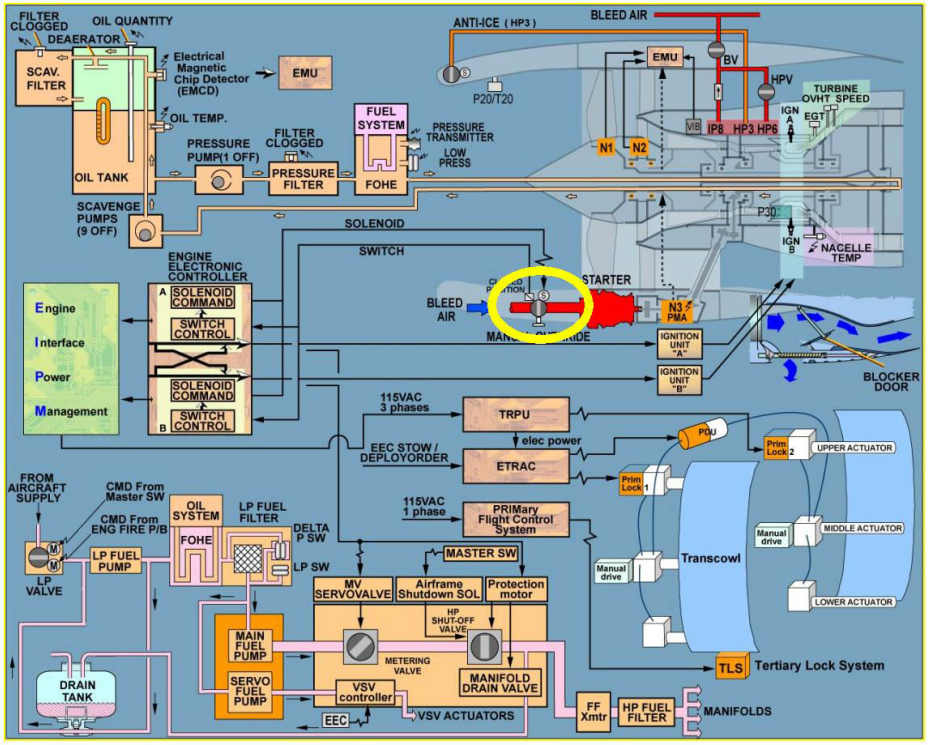




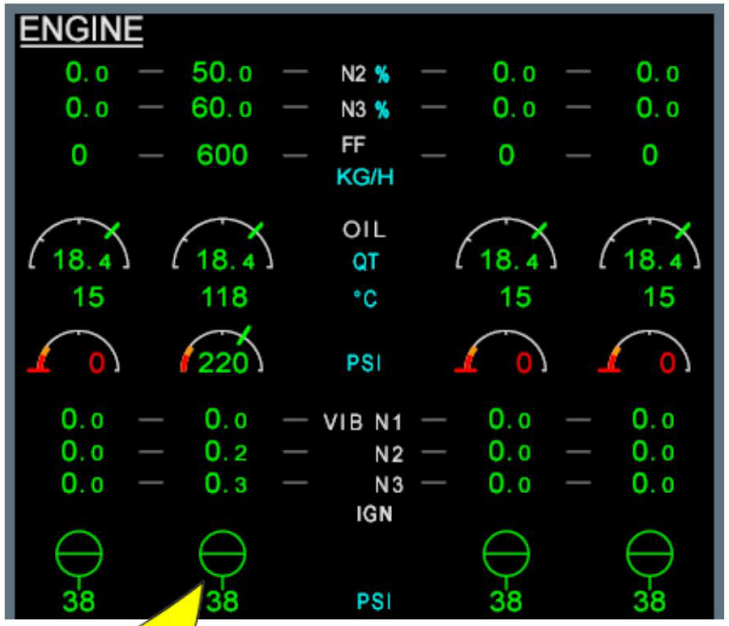


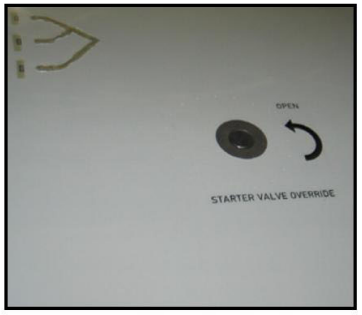


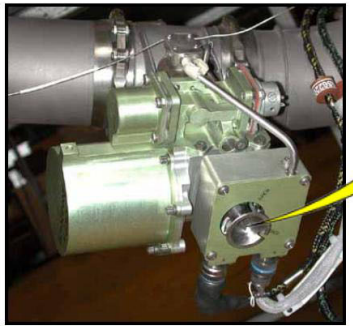
ENGINE START WITH ASSISTANCE - ENGINE MANUAL START



COCKPIT CREW ORDERS TO MECHANIC, FOR CLOSURE OF THE STARTER CONTROL VALVE AT ENGINE N3 SPEED ABOVE 50%.







ENGINE START WITH ASSISTANCE - ENGINE MANUAL START

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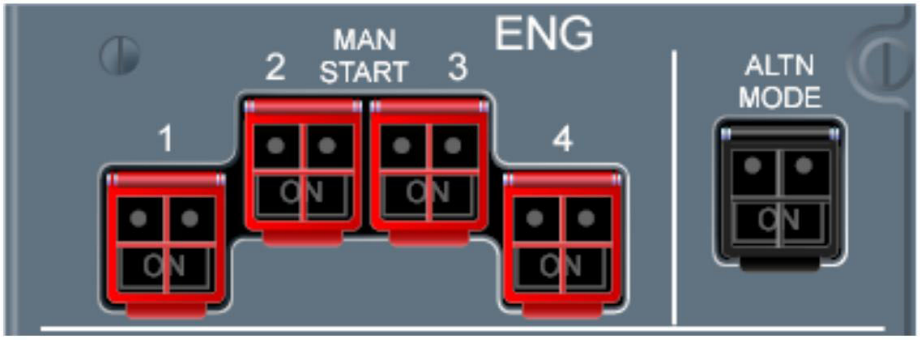
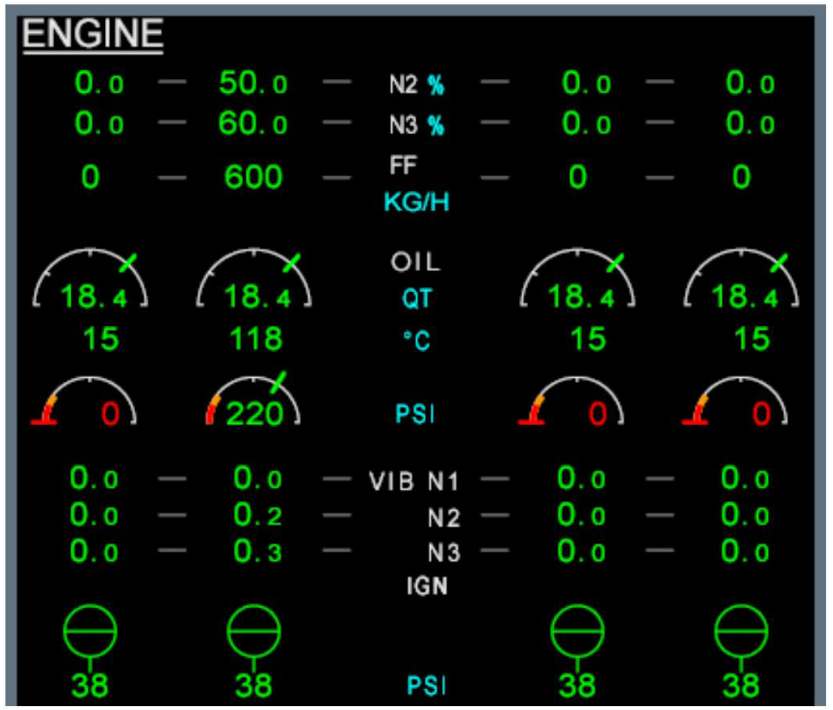
ENGINE START ASSISTANCE OPS, CTL & IND (2)

After Engine Start

NOTE: Icing conditions may be expected if the OAT is below 8°C with visible moisture (fog).



ENGINE START COMPLETED



AFTER ENGINE START

ENGINE START ASSISTANCE COMPONENT LOCATION (2)

A/C Zone 400

Starter Main Components

Starter Control Valve

Access and Tool

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